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ABSTRACT

Project AIMS (Activities to Integrate Mathematics and Science) has as its purpose the integration of subject matter in grades K-9. Field testing of the curriculum materials produced by AIMS indicates that this integration produces the following beneficial results: (1) mathematics becomes more meaningful, hence more useful; (2) science is increasingly studied and understood, with a significant economy of time; (3) there is improved quality of learning and retention; and (4) there is a dramatic increase in students' motivation and involvement. This teaching guide to animals for grades k-6 contains 39 lessons, each with a teaching instructions page with lists of materials, objectives and procedures, and reproducible worksheets for students. Topics include: (1) "Insects and Spiders"; (2) "Mealworms"; (3) "Earthworms"; (4) "Snails"; (5) "Silkworms"; (6) "Isopods"; (7) "Aquatic Critters"; (8) "Adaptation and Camouflage"; and (9) "Food Chain." Also included is a vocabulary list for the unit, an index of skills, a list of children's literature to be used to extend these activities, a letter for parents, and information on the AIMS project. (CW)

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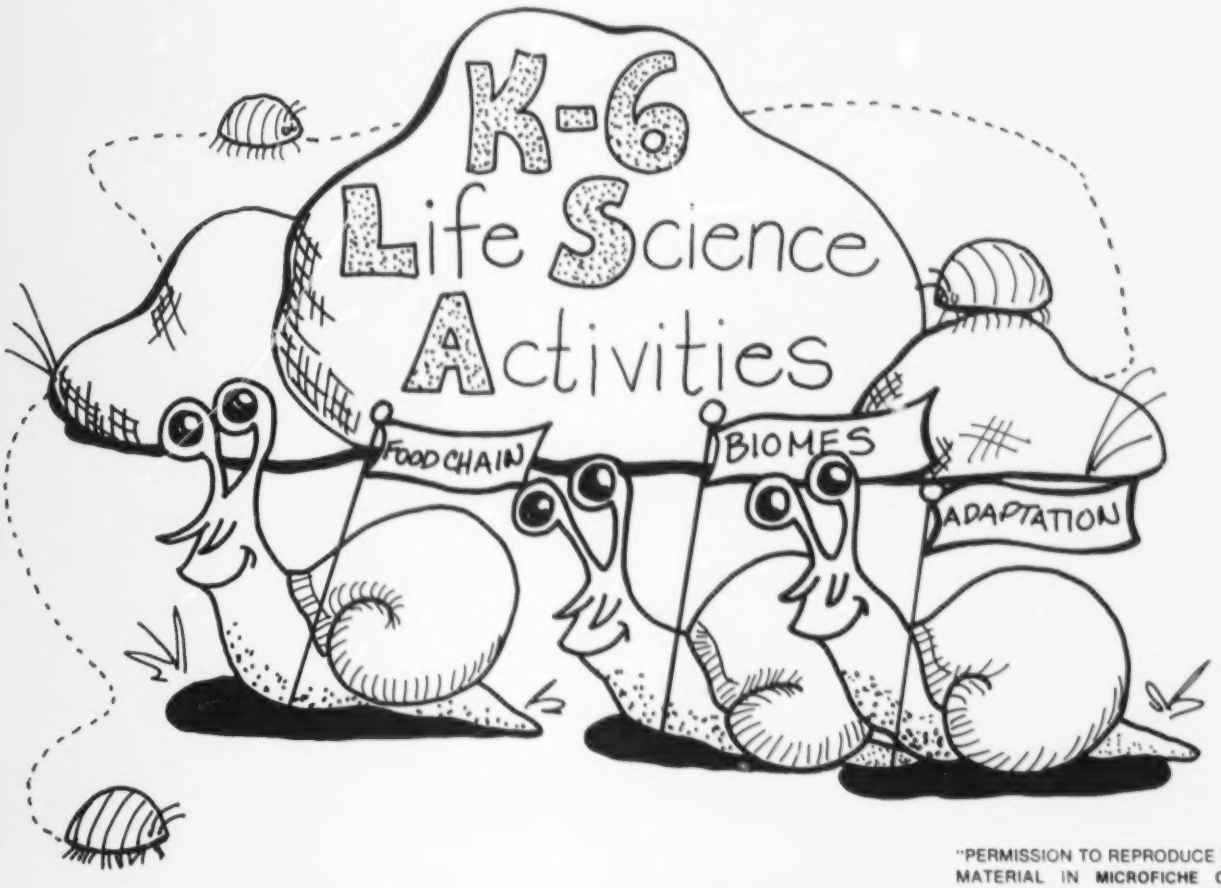

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Project AIMS

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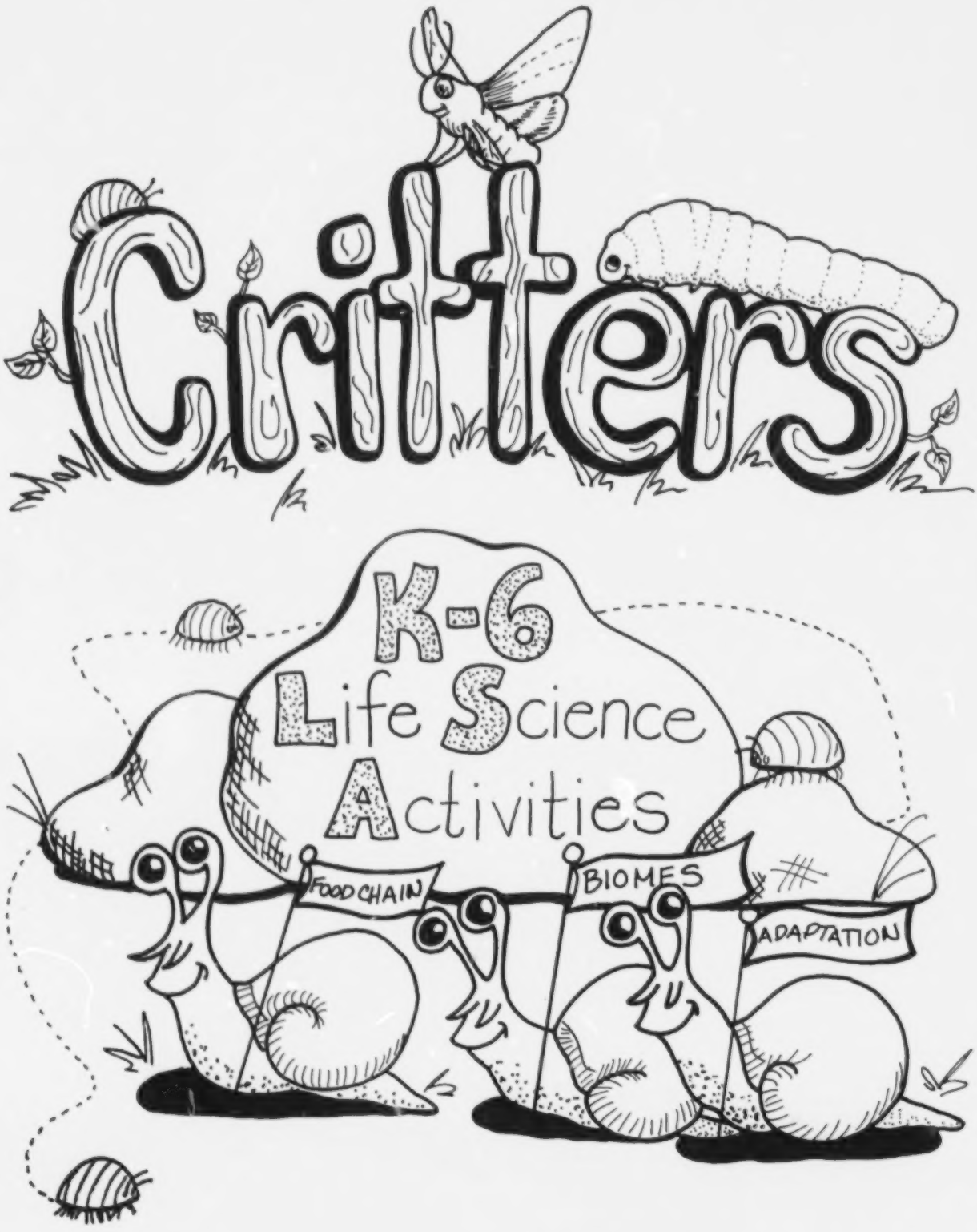

Project **AIMS**

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Project AIMS

Project AIMS has as its purpose the integration of subject matter in K-9. Such integration enriches and makes learning meaningful and holistic. Project AIMS began as a program to integrate mathematics and science, but has since developed to also include language arts, social studies, and other disciplines. The acronym "AIMS" stands for "activities to integrate mathematics and science."

Project AIMS is a continuing, non-profit project of Fresno Pacific College. It had its inception in a National Science Foundation funded program to train teachers in the integration of mathematics and science. This quickly created the necessity to write instructional materials incorporating this concept. Despite the fact that thoughtful educators have long recommended this approach, very little appropriate material was available.

Currently, Project AIMS is funded solely through the sale of this developing series of books. All net proceeds from their sale flow into a trust fund administered by Fresno Pacific College. The use of this fund is restricted to the support of continued research and development, partial scholarships for classroom teachers who participate in the writing and field testing teams, and the publication of the books.

The rationale for this integrative thrust lies in the fact that science, mathematics, language arts, social studies, etc., are integrally interwoven in the real world outside the classroom, from which it follows that they should be similarly treated in the classroom if we are to prepare our students for life in that world. Teachers who have used Project AIMS lessons give enthusiastic endorsement to the effectiveness of this approach.

Science encompasses the art of questioning, investigating, hypothesizing, and discovering. Mathematics is the language that provides clarity, objectivity, and understanding. The language arts provide us with powerful tools of communication. Many of the major contemporary issues involve societal issues stemming from advancements in science. It is time, therefore, that all of us in the teaching profession take seriously using a more holistic mode of transmitting knowledge to students. It is this that motivates all of us who are involved in creating or using the integrative materials of Project AIMS. We invite you to join us in this effort.

Extensive field testing of these materials confirms the following beneficial results.

1. Mathematics becomes more meaningful, hence more useful, when it is applied to situations that interest students.

2. The extent to which science is studied and understood is increased, with a significant economy of time resulting from the integration of two or more disciplines.

3. There is improved quality of learning and retention, supporting the thesis that learning which is meaningful and relevant is more effective.

4. Motivation and involvement are increased dramatically as students investigate real world situations and participate actively in the process.

We invite you to become part of this classroom teacher movement by using an integrated approach and by sharing any suggestions you may have or investigations you would recommend. Project AIMS welcomes you!

Project AIMS Publications

GRADES 5–9 SERIES

Math + Science, A Solution

The Sky's the Limit

From Head to Toe

Fun With Foods

Floaters and Sinkers

Down to Earth

Our Wonderful World

Pieces and Patterns, A Patchwork in Math and Science

Out of This World, Book A

Soap Films and Bubbles (4-9)

GRADES K–4 SERIES

Fall Into Math and Science

Cáete de gusto hacia el OTOÑO con las MATHEMÁTICAS y CIENCIAS

Glide Into Winter With Math and Science

Patine Al INVIERNO con MATEMÁTICAS y CIENCIAS

Spring Into Math and Science

Brinca de alegria hacia la PRIMAVERA con las MATEMÁTICAS y CIENCIAS

Seasoning Math and Science, Book A (Fall and Winter)

Seasoning Math and Science, Book B (Spring and Summer)

Jawbreakers and Heartthumpers

Hardhatting in a Geo-World

Popping With Power

Overhead and Underfoot

Primarily Plants

GRADES K–6

Primarily Bears, Book 1

Water Precious Water, Book A

Critters

FOR FURTHER INFORMATION WRITE TO:

AIMS Education Foundation
P.O. Box 8120
Fresno, California 93747

I HEAR, AND I FORGET

I SEE, AND I REMEMBER

I DO, AND I UNDERSTAND

–Chinese Proverb

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Extend AIMS Lessons with Children's Literature

During summer AIMS workshops Debby Deal and Gale Kahn encouraged teachers to submit the names of favorite books that related to various AIMS activities. Below are two such lists, one for primary grades and the other for middle grades. We encourage our readers to help us expand these lists. AIMS places heavy emphasis on the integration of learning and is pleased to print the following information.

PRIMARY

Lesson Topic	Book Title	Author
Feet/Shoes	Foot Book	Dr. Seuss
	The Aminal	Bulian
	The Very Worst Monster	Hutchins
	Shoes	Winthrop
	Funny Feet	Weiss
Fruits/Vegetables/Health	The Very Hungry Caterpillar	Carle
	Gregory, The Terrible Eater	Sharmat
Seeds/Leaves	Reason for a Flower	Heller
	Fall of Freddie Leaf	Buscaglia
	Pumpkin, Pumpkin	Titherington
Detective	Detective Whooo	Panek
Ghosts	Georgie The Ghost Book	Bright
	The Haunting of Grade 3	???
	Cranberry Halloween	Devlin
	Great Halloween Scare	???
	The Ghost Eye Tree	Martin
	Little Old Lady Who Wasn't Afraid of Anything	Williams
Rainbow	Plant a Rainbow	Ehlert
	Little Blue and Little Yellow	Lionni
Flower	Plant a Rainbow	Ehlert
	The Reason for a Flower	Heller
Start of School	The Blanket Had To Go	Evans
Fish	Fish Out of Water	???
	Yeh-Shen	Louie
Bears	Teddy Bear Picnic	Kennedy
	Corduroy	Freeman
	When a Bear Bakes a Cake	Tomkins
	Ten Bears in My Bed	Mack
	Big Bad Bruce	Peet
	Teddy on Time	Pellowski
Eggs	Are You My Mother?	Eastman
	Chickens Aren't the Only Ones	Heller
	Seven Eggs	McKenna
	What's Hatching Out of That Egg	Lauber
Snails	The Biggest House in the World	Lionni
	Snails Spell	Ryder
Dinosaurs	Weekly Reader — Dinosaur Kit 4343 Equity Dr., Columbus, OH 43228 Pat Perea Materials, S/S Pub. Co. 3550 Durock Rd. Shingle Springs, CA 95682 (916) 677-1545	
	Dinosaur Pop-up Book	Barlowe
	Patrick's Dinosaur	Carrick
Popcorn	The Popcorn Book	de Paola
	Popcorn	Asch
Measurement	Inch By Inch	Lionni
	How Much Is A Million?	Schwartz
Animals	Annie and Wild Animals	Brett
	The Big Snow	Hader
	Dear Zoo	Campbell
	Animal Fact/Animal Fable	Simon
	Animals Born Live and Well	Heller
Camouflage	How to Hide a Butterfly	Heller
	Where's Waldo	Handford
	The Trek	Jonas
	Animals Who Change Their Color	Almand
Pet Rock	Everybody Needs a Rock	Baylor
Jelly Beans	The Jelly Bean Contest	???
Eyes	People	Spier
	Illusions	Troll Assoc.
Art	Make a World	Emberley
Hermit Crabs	Does Anyone Know Where a Hermit Crab Goes?	???
Space/Sun	The Sun Our Nearest Star	Branley
	What Makes Day and Night	Branley
	Done in the Sun	Hillerman
Weather	Snow is Falling	Branley
	Sunshine Makes the Seasons	Branley
	Flash, Crash, Rumble and Roll	Branley
	Cloudy with a Chance of Meatballs	Barrett
Shadows	Shadow Chaser	Cosgrove
Miscellaneous	Do You Know?	Ford
	The King Who Rained	Gwynne
	The Jolly Postman	Ahlberg
Creature Features	Where the Wild Things Are	Sendak
Fun Fruits	Huge Harold	Peet
	Hubert's Hair Raising Adventure	Peet
Bubbles	Unbelievable Bubble Book	Cassidy
Apples	Ten Apples up on Top	Dr. Seuss
Observation	Anamalia	Base
	Wilfred Gordon McDonald Partridge	Fox
	Do Not Open	Turkle
Corn	Corn is Maize	Aliki
Moon	Moonbeam on a Cat's Ear	Gay
Questions	How Come?	Richards
Nature	King's Flower	Anno
Body Parts	Here Are My Hands	Martin, Jr.
Insects	Squiggly Wiggly's Surprise	Shapiro
	How Many Bugs in a Box	Carter
Senses	Series. . . Sight, Hearing, Touch, Smell, Taste	Ruis
Self Esteem	Quick as a Cricket	Wood
Birds	Owl Moon	Yolen
Numbers	Anno's Counting Book	Anno
Water Fun	King Bidgood's in the Bathtub	Wood
Magnets	Mickey's Magnets	Cranley
Serial Ordering	Where in the World is Henry?	Balian
Asking Questions	Owly	Thaler
Heat, Water	Snowy Day	Keats
Earth/Physical Science	Pecos Bill	Kellogg
Songbook	All Year Songbook	Scholastic
Plants	Seedling Child	Bornstein
Critters	Fables	Lobel
	Aster Ardvarks Alphabet Adventures	Kellogg
	Barn Dance	Martin
	Q is for Duck an Alphabet Guessing Game	Elting
	Silkworms	Johnson
	Very Hungry Caterpillar	Carle
	Predator Prey Puppets	Mah
	Beastly Neighbors	Rights
Foods	Alligator Arrived with Apples	???
	A Potluck Alphabet Feast	???
	Cresent Dragonwagon	???
Spiders, Lettuce	Lady and the Spider	McNulty

MIDDLE GRADES

Lesson Topic	Book Title	Author
Rocks	Everybody Needs a Rock	Baylor
	Syllvester and the Magic Pebble	Steig
Measurement	How Tall Was Milton	Lowery
Insects	101 Bug Jokes	Eisenberg
General Information	What?	Reece
	Random House Book of Poetry	Prelutsky
Camouflage	How to Hide. . . Series	Heller
Seasons	Frederick	Lionni
Animals	Animals Born Alive and Well	Heller
Ecology	Introducing Ecology: Nature at Work	British Museum
Music	Peter and the Wolf	
Senses	Look Again	Hoban
Fractions	Gator Pie	Mathews
Boats	Paddle to the Sea	???
	Three Days on a River in a Red Canoe	Williams
Geology	Ming Lo Moves the Mountain	Lobel
Classification	Bruno Brontosaurus	Rubel
Weather	Cloud Book	de Paola
Bears	Baby Bears	National Geographic
	Happy Birthday Moon!	Asch
	Corduroy	Freeman
	Who Wants an Old Teddy Bear?	Hofmann
	Teddy Roosevelt and his Teddy	???
Popcorn	The Popcorn Book	de Paola
Numbers	How Much Is a Million?	Schwartz
Multiplication	Bunches & Bunches of Bunnies	Mathews
Language	The Jolly Postman	Ahlberg
Money	Alexander Who Used to be Rich Last Sunday	Viorst
Mirrors	The Mirrorstone	Palin
	If You Give a Mouse a Cookie	Numeroff

Mathematics: A Way of Thinking
Center for Innovation in Education
19225 Vinegar Lane
Saratoga, CA 95070

Family Math
Univ. of California, Berkeley
Lawrence Hall of Science
Berkeley, CA 94720

Standard and Expanded AIMS Duplication Programs

It is the goal of the AIMS Education Foundation to make its materials and programs available to schools and educators at reasonable cost consistent with the maintenance of high standards of quality.

The support for continued research, development, field-testing, and publication of AIMS materials is dependent entirely on the revenue produced from the sales of books, posters, the AIMS Newsletter, and other publications of the Foundation.

It is, therefore, of utmost importance that all educators and educational agencies carefully observe the generous privileges and applicable restrictions for duplication.

Two broad types of duplication privileges are offered: standard and expanded. Within the expanded duplication program Class I and Class II contracts are available. Each of these is defined in detail below.

Standard Duplication Privileges

A school or individual purchasing any AIMS publication is granted the right to make up to 200 copies of any of the materials therein for use by teachers at that school site.

Workshop leaders may make up to 200 copies in the same manner as schools. Teachers receiving copies from workshop leaders may duplicate no more than 35 copies of student pages received in a workshop or enough to use the lessons one time with one class. Any further duplication without the purchase of the materials is strictly forbidden.

All educators conducting AIMS workshops are expected to explain the Model of Mathematics and Model of Learning and consistently refer to it as activities are presented since these Models are the basis on which the AIMS program rests. Such understanding is essential to achieve the highest possible benefit from AIMS.

If an educational agency publishes a newsletter or similar publications for distribution to multiple sites, no more than 200 copies of any AIMS materials included therein may be made without written permission from the AIMS Education Foundation. Further, such multiple-site newsletters may duplicate no more than one science activity and one mathematics activity from any one issue of the AIMS Newsletter or book.

Whenever AIMS materials are duplicated in any form the AIMS Education Foundation copyright must appear. In the case of newsletters or similar publications information regarding the availability of AIMS publications and the fact that they may be ordered from the Foundation must be noted.

Extended Duplication Contracts

The AIMS Education Foundation has approved programs whereby schools, school districts, and other non-profit educational agencies may purchase additional duplication rights. These programs are particularly appropriate for districts who wish to publish AIMS materials in a central office for district-wide use or to publish more than the 200-copy limit which comes with the purchase of a book.

Two classes of rights are available:

A Class I contract provides for the purchase of the right to duplicate an additional 250 copies beyond the 200-copy limit that accompanies the purchase of a book; and,

A Class II contract permits the duplication of an unlimited number of copies for use at given school sites. **A special provision of this contract extends this duplication right to revised editions of any of the books covered.**

Both Class I and Class II contracts are based on the **book/site unit.**

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Examples of Contract Elements and Costs

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3. The class of contract that is requested.

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Address all correspondence and purchase order to:

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P.O. Box 8120
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AIMS Newsletter Subscription Information

Each issue of the AIMS Newsletter contains a wealth of resources consisting of new AIMS integrated mathematics/ science investigations, simple science experiments, and problem solving mathematics activities.

The AIMS Newsletter is published monthly, August through May. Subscriptions are on an annual basis only. A subscription entered at any time will receive the 10 issues for that year beginning with the previous August issue. This format is used since many of the articles in an annual volume are interrelated and all need to be available for maximum benefit.

The average issue of an AIMS Newsletter contains four or more new AIMS investigations, at least one each at the K–1, 2–4, and 5–9 grade levels; one 8.5 x 11 inch blackline master poster describing a simple science experiment; two 8.5 x 11 inch blackline master posters displaying problem solving situations; information about developments in the AIMS program, workshops, courses, and other activities; feature articles of lasting value dealing with science instruction, problem solving in mathematics, etc.; a description of how a school, district, or state is implementing AIMS in a systemmatic manner; activities by members of the AIMS National Leadership Network and the writing teams; a thorough preview of all new AIMS and SETUP publications; information about conference presentations by the program directors of AIMS where participants can meet with them personally; and a periodic listing of all AIMS publications.

The problem solving poster series in the Newsletter is accompanied by a thorough analysis of problem solving approaches appropriate to each situation. This analysis serves as an aid to classroom teachers who wish to enhance their own knowledge of problem solving and help students acquire an inventory of problem solving skills. Authored by Wilbert Reimer and Arthur Wiebe, both of whom studied extensively under Dr. George Polya at Stanford University, both series reflect his influence.

The ten issues in the annual volume contain forty or more new AIMS investigations, ten science posters, and twenty problem solving challenges, plus numerous articles dealing with the teaching of "hands-on" science, evaluating higher order thinking skills and student progress in mastering process skills, and other enriching resources.

Since duplication rights for one school site are granted for all materials published in the Newsletter, it is highly cost effective for a school to enter a subscription and build a library for the use of all of its teachers.

The annual subscription price is $22.50. Volumes I and II are still available.

AIMS Newsletter Subscription

Subscriptions are accepted on an annual basis only. Subscriptions entered at any time during the year receive all issues of that year, August – May.

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____ Volume II issues 1987–88
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____ Volume V subscription 1990–91

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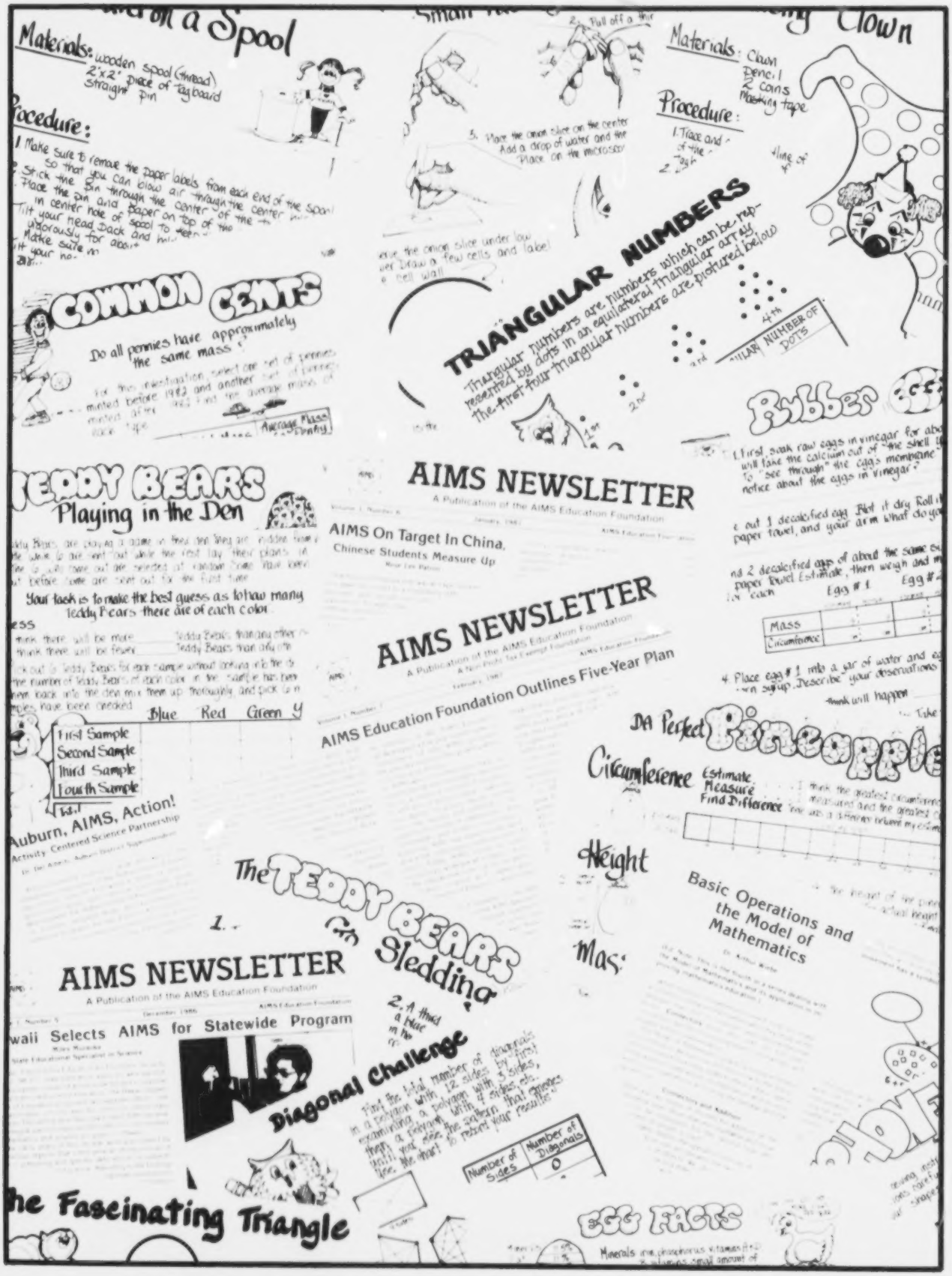
Materials:
Procedure:
COMMON CENTS
Do all pennies have approximately the same mass?
TRIANGULAR NUMBERS
Triangular numbers are numbers which can be represented by dots in an equilateral triangular array. The first four triangular numbers are pictured below
Clown
Materials:
Procedure:
Bubbles
TEDDY BEARS
Playing in the Den
Your task is to make the best guess as to how many teddy bears there are of each color
AIMS NEWSLETTER
A Publication of the AIMS Education Foundation
AIMS On Target In China
Chinese Students Measure Up
AIMS NEWSLETTER
AIMS Education Foundation Outlines Five-Year Plan
Blue
Red
Green
First Sample
Second Sample
Third Sample
Fourth Sample
Auburn, AIMS, Action!
Activity Centered Science Partnership
Circumference
Estimate
Measure
Find Difference
Height
Basic Operations and the Model of Mathematics
The TEDDY BEARS Go Sledding
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Hawaii Selects AIMS for Statewide Program
Diagonal Challenge
Number of Sides
Number of Diagonals
The Fascinating Triangle
EGG FACTS

AIMS Education Foundation Programs

The AIMS Education Foundation sponsors a variety of programs and services. Write for additional current information about any of these:

AIMS National Leadership Program in Math/Science

The Leadership program provides training in science and mathematics for teachers in grades K–9 using the AIMS integrated mathematics/science approach. Intensive training is provided in the physical, biological, earth science, and mathematics topics and the science process skills.

Participants receive 300 hours of instruction in a two-summer sequence. During each academic year following, the participant provides a minimum of 40 hours of instruction to teachers in the local district or region.

Upon successful completion of these requirements, trainers qualify to become members of the AIMS National Leadership Network, conduct AIMS workshops, teach AIMS in-service courses for college credit, and serve as AIMS consultants to help meet the widespread demand for such services.

The program the first summer consists of the AIMS National Leadership Institute (three weeks in July). The second summer schedule consists of the Festival of Mathematics (two weeks in late June). Write for current information.

AIMS One-Week Summer Workshops

The AIMS Education Foundation will offer 50 or more one-week AIMS Workshops nationally each year. The sites are selected from applicant educational organizations who wish to serve as the hosts. Each workshop is of five days duration and includes 30 hours of instruction, primarily hands-on, in AIMS. Most are offered in three grade level sections, generally K–1, 2–4, and 5–9. Participants receive $50+ in materials.

Host agencies agree to provide appropriate classroom space and related services at no cost to the Foundation and to cooperate in the promotion of the workshop. This is the only cost to the host agency. The AIMS Education Foundation pays all instructional costs; the housing, meals, and travel of instructors; and workshop materials and supplies. During 1990 the cost per participant is $195. Instructors are members of AIMS National Leadership Network.

Educational agencies interested in making application to host a workshop should request current information and application forms.

AIMS On-Campus Workshops

Each summer AIMS offers one-week AIMS Workshops at Fresno Pacific College in Fresno, California. The program directors of the AIMS Education Foundation and key members of the AIMS National Leadership Network serve as instructors. Two semester units of graduate credit are available.

Science Festival and Festival of Mathematics

Fresno Pacific College offers outstanding programs each summer: the Science Festival and the Festival of Mathematics. Guest faculty include some of the nation's most highly regarded mathematics and science educators. Provision is made for all grade levels from kindergarten through high school.

These two Festivals offer a unique educational experience and annually draw a total enrollment of more than 600 teachers from across the nation.

"A Day with AIMS"

"A Day with AIMS" offers an intensive one- and two-day AIMS workshops to introduce teachers to AIMS and its philosophy. Participants become familiar with the basic principles incorporated into AIMS; engage in an extensive series of hands-on AIMS investigations; and discuss classroom management and methods for integrating AIMS into the curriculum. Participants receive more than $30 worth of materials, including their choice of two AIMS publications. These workshops can be offered ***in any part of the nation*** based on a minimum enrollment of 30 participants. The cost is $70 per person.

Information Request

Please send current information on:

_____ AIMS National Leadership Program
_____ AIMS On-Campus Workshops
_____ AIMS Off-Campus Workshop Schedule
_____ Science Festival
_____ Festival of Mathematics
_____ "A Day with AIMS" Schedule
_____ "A Day with AIMS" hosting information

Name: _____

Address: _____
Street City State Zip Code

Mail to: **AIMS Education Foundation, P.O. Box 8120, Fresno, CA 93747**

Dear Parents

Our class will be doing a number of hands-on math/science activities. These life science activities involve a variety of critters ie. insects, snails, etc... The activities combine science processes with mathematical skills.

The critter activities will require a number of materials. We would greatly appreciate your contribution of any of the materials listed below. Please send the materials that you are willing to donate to school by _____.
date

Thank-you very much,

_____
teacher

_____
child

Materials List

- 2 liter soda bottles
- lg. jar with lid
- ½ gal. milk carton
- plastic shoebox
- animal cookies
- goldfish crackers
- gummy worms
- gravel
- clear plastic cups (10 oz.)
- toilet paper tubes
- feathers
- wax paper
- popsicle sticks
- toothpicks
- egg cartons
- marshmallows
- yarn
- sandwich baggies (ziploc)
- mulberry leaves
- aluminum foil
- baby food jars

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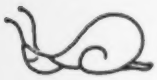
A COLLECTING WE WILL GO...

Snails...



Snails can be found early in the morning and late at night in moist spots in your yard. They are underneath and on the sides of moist leaves and walls. To make a snail catcher, use a square of black or brown trash bag, set it on top of moist ground for 2 days. Collect the snails in the early morning or evening; they will be underneath the plastic.

Isopods...

Isopods can be found in cool, moist locations. They are under wood, clumps of ground cover, and rocks. To make an isopod collector, hollow out a potato and set it in a cool, moist location overnight.

Mealworms...

Mealworms can be purchased at any pet shop or fish bait store. If you want them to remain in the larval stage, refrigerate them. Otherwise, at room temperature, the life cycle will continue.

Earthworms...

Earthworms can be found on the surface after a rain or by digging in rich, moist soil. Another way to obtain earthworms is to purchase them at a pet shop or bait shop. (Note: earthworms are often called "nightcrawlers".)

Brine Shrimp... Brine shrimp can be purchased at a toy store or pet shop.

Goldfish...

Goldfish can be purchased at any pet shop. Be sure to ask about your local water, dechlorinators are often required.

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CRITTERS
Vocabulary List

abdomen: the last section of an insect's 3 main body parts

adapt: changing to fit the environment

antennae: (singular; antenna) the sensory organs of an insect — Antennae are used to smell, taste, feel, and sometimes hear.

biome: ecosystems that have similar wildlife, climates and vegetation

camouflage: an organism's ability to blend in with the environment

carnivore: animal that eats meat

census: the counting of a population

chrysalis: the pupal case of many butterflies

cold-blooded: an animal that cannot maintain a constant body temperature independent of the outside temperature — Insects, reptiles, fish, and amphibians are cold-blooded.

cocoon: the pupal case of many moths that is made out of a silk like material

consumer: higher level organisms that get their food from other living things

gills: organs in fish that separate dissolved oxygen from water

habitat: the environment in which an animal lives

herbivore: animal that eats only plants

invertebrate: animals without backbones

larva: (plural; larvae) the second stage of an insect that goes through complete metamorphosis (i.e., egg-larva-pupa-adult) — Insect larvae look very different from the adults. For example, moth or butterfly larvae are caterpillars, fly larvae are maggots, and beetle larvae are grubs.

life cycle: series of stages through which an organism passes.

metamorphosis: the stages of development through which an organism changes its body form

molt: to shed the outer skin or exoskeleton. As an insect grows, it sheds its skin several times before it reaches the adult stage.

nymph: the immature stage of an insect that goes through incomplete or simple metamorphosis — It looks like the adult but is much smaller.

omnivore: animal that eats both plants and animals

population: total number of organisms of one species in a particular area

predator: animal that eats other animals

prey: animal that serves as food for another animal

producer: green plants that are able to make their own food

pupa: (plural; pupae) the inactive stage of an insect that goes through complete metamorphosis — The larva changes into a pupa, and then becomes an adult.

spider: an arthropod that has 2 main body parts, 8 legs, and fangs — Spiders are related to insects.

thorax: the middle section of an insect's body to which the legs and wings are attached

vertebrate: animals with backbones

warm-blooded: animals that are able to maintain a constant body temperature independent of the outside temperature — Birds and mammals are warm-blooded.

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HOME ON THE RANGE

I. Topic Area
Critter homes

II. Introductory Statement
Students will identify several critters and their environmental needs and assign them to appropriate homes.

III. Math Skills **Science Processes**
a. Observing
b. Collecting & organizing data
c. Classifying
d. Inferring
e. Applying

IV. Materials
activity sheets
scissors
glue
crayons
materials to make critter homes

V. Key Question
What would be needed to build a suitable, humane home for critters?

VI. Background Information
Students are fascinated by critters and often want to keep them in a jar or box with inadequate ventilation and no food or water. They need to be taught that even small animals like isopods and ants have needs and should be treated humanely. This activity is meant to make students aware of the kind of homes that would provide a good environment for various critters. These homes can easily be constructed from inexpensive materials. Below is a description of the four homes pictured on the activity sheets.

1. Two liter plastic bottle home — soil & cupful of water
   butterfly, lizard, ant, tarantula, snake, snail
2. Jar home — branch, gravel and a cup of water
   butterfly, snake, lizard, tarantula, ant
3. Milk carton home — oatmeal and a slice of potato
   mealworm, isopods
4. Plastic shoebox-aquarium home — water and a rock
   fish, tadpole, turtle, aquatic snails

VII. Management Suggestions
1. Have a selection of small animals and their homes available for the students to observe, if possible, to help stimulate class discussion about suitable critter homes. These could be things like fish in a bowl or aquarium, ants in an ant farm, a bird in its cage, etc.
2. The inexpensive homes recorded on "Home on the Range" are suggested for use as classroom critter homes and if possible, an example of each should be available for students to examine.
3. This activity can be done in one or two days. The students can do this as a paper and pencil activity or they can actually build one of the homes.

VIII. Procedure
1. Discuss the key question and talk about the things that must be considered in order to safely and humanely keep small animals in the classroom.
2. Talk about each home on the "Find Me a Home" activity sheet. Have students select the critters that can live together and discuss what homes would be appropriate for them. They can cut out the pictures of the critters and paste them on an appropriate home.
3. "Home on the Range" shows four easy to make, inexpensive critter homes. Discuss these homes and their features. Working in teams or individually, students can design an additional critter home and draw a picture of it on the activity sheet.
4. Students can build one of the four homes or one of their own design. The teacher may want to have a collection of materials available for students to work with, such as milk cartons, juice cans, plastic juice bottles, nylon stocking, rubber bands, tape, shoeboxes, etc.
5. If homes are built to keep live critters, students must provide their critters with the proper care.

IX. Discussion Questions
1. What would happen if you put the lizard in the milk carton?
2. Which other critters must have specific homes? Why?
3. Which critters could live in any of the homes? Why?
4. Besides creating a safe home for class pets what else is important in their environment?
5. How could a critter's need for food and water be met in each of the homes?

X. Extended Activities
1. Research a particular critter and report your findings.
2. Use the "You won't believe what's in my jar!" page and write a story.

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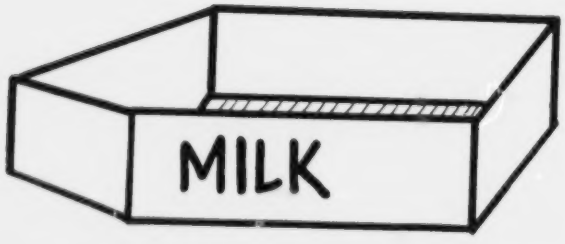
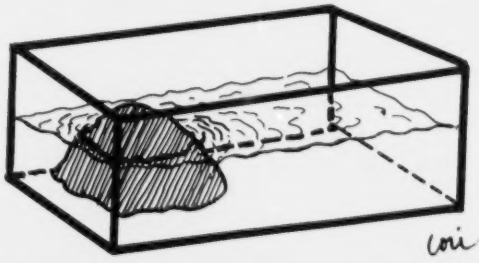
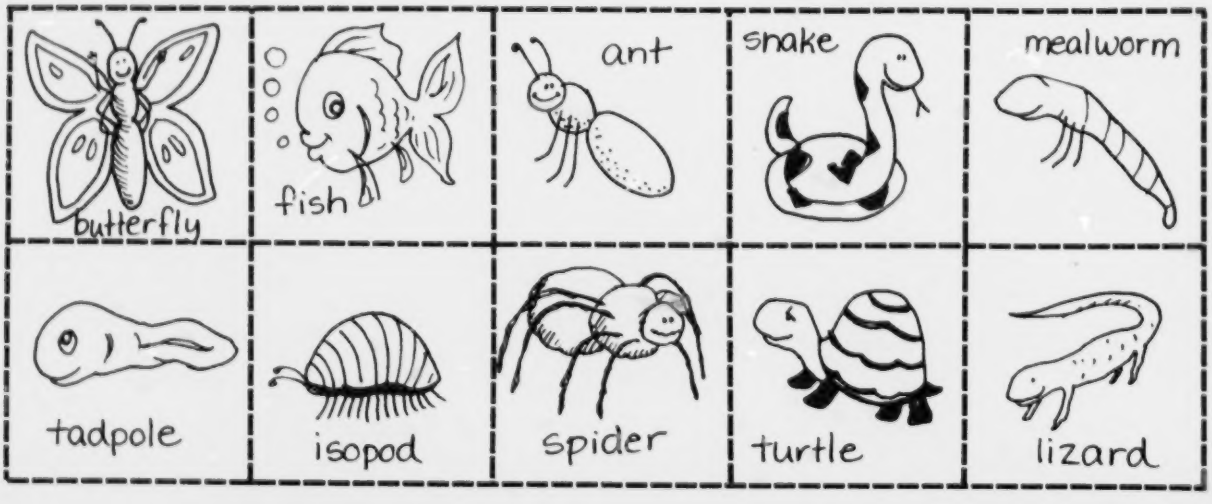
Find me a home...

Cut out the critters at the bottom of this page... glue them on the best home... select one for each home







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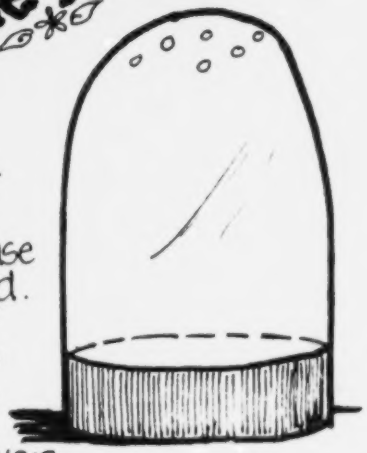
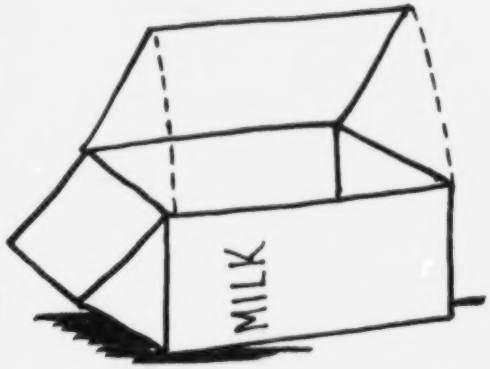
Home on the Range



Use a 2-liter bottle with base removed. Cut off the top of the bottle, turn over, and place inside the base. Poke holes in the top with a nail.



Use a milk carton with one side cut off. If you need a lid, use plastic wrap poked with holes, and tape down.

Use a jar with holes poked into the lid.

Use a plastic shoebox. If a lid is needed, an adult can use a hot nail to poke holes in the plastic lid.

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Design a new critter home that is easy to build.....

_____ loves to live in this home!

You won't believe what's in my jar!

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ANIMAL ANTICS

I. Topic Area
Animal classification

II. Introductory Statement
Students will sort animals into appropriate classifications in the Animal Kingdom.

III. Math Skills
a. Graphing
b. Computation

Science Processes
a. Observing
b. Classifying and sorting

IV. Materials
activity sheets
classification chart
bags containing any or all of the following:
animal cookies, duck or goldfish crackers, gummy worms, plastic bugs, spiders, snakes, lizards and pictures of animals

V. Key Question
How do scientists classify animals?

VI. Background Information
The Animal Kingdom can be classified into two groups, the vertebrates and the invertebrates. Vertebrates are animals with a backbone and can be classified into five sub groups: mammals, birds, fish, reptiles and amphibians. The invertebrates are classified into *many groups*, but for this activity will only be sorted into four sub groups: ringed worms, arthropods (insects, spiders, crabs), mollusks (slugs, squid, snails) and echinoderms (spiny skinned animals like starfish, sea urchins and sand dollars). This activity is dealing with classification on an elementary level and is not intended to be complete, but rather to expose elementary students to the idea of classifying animals into groups according to attributes they have in common. Likewise, this activity may be too complex for primary students, but a creative teacher can use the pictures and have students sorting and classifying on a more primary level.

VII. Management Suggestions
1. This activity can be done as a game as described below or simply as a sorting exercise using the animal pictures and the fact sheets to classify animals.
2. Two sheets of animal pictures are included with the activity. One sheet depicts the animals accurately and one is more stylized. Either sheet may be duplicated to provide animal pictures for the class to sort and classify.
3. Each group will get a bag containing as many animals (animal pictures, toys, cookies, etc.) as possible to sort.
4. The Animal Kingdom fact sheets can be used to help students who are not familiar with animal classification.
5. The classification chart used for this activity is on two pages that need to be run off separately and taped together. Each group will need a chart.

VIII. Procedure
1. Each team is given a bag containing approximately the same number of animals to sort.
2. Let the students look at the animals they have in the bag for a few minutes and then return the animals to the bag.
3. Pass out the activity sheets and chart and explain that the object of the game is to correctly sort the animals according to the classification system given on the chart.
4. Discuss the point system for the game as given on the data sheet. Have students predict how many points they think they will get and record their prediction on the data sheet.
5. Have the team place the animals at the top of the chart in the section marked "All Animals" and count them. Record this number on the data sheet.
6. The team will then divide their animals into two groups (vertebrates and invertebrates) on the chart. Check the teams for correct placement. One point for each correct placement is given and recorded on the data sheet.
7. The team will then sort the vertebrates into one of five categories on the chart. The teacher will check for correct placement and points are then calculated for all the correct classifications. For example, if the team correctly classified 3 reptiles, they will get 3 × 4 or 12 points and record these points on the data sheet.
8. The same procedure is followed for the invertebrates.
9. After each team has calculated its score, the scores of all the teams can be recorded and graphed on the graphing page.

IX. Discussion Questions
1. What do the mammals have in common? The reptiles? The mollusks? etc.
2. Was your predicted score close to your team's score? Why or why not?
3. Which group of animals is most often selected as pets? Why do you think this is so?
4. How would you sort the mammals into smaller categories?
5. Can you devise an animal classification system that is different from the one given on the chart?

X. Extended Activities
1. A large classification chart can be drawn on butcher paper and placed on a bulletin board. Each student can cut out and color an animal picture and paste it on the chart in the appropriate place.
2. Older students can find the ratios or percents of animals they had in each category on the chart.
3. Younger students can do the activity with only the animal pictures and sort them any way they want.

XI. Curriculum Coordinates

Art:
Use the cut out animals to make a zoo picture.

Creative Writing:
Students can write an animal story. The "Just So Stories" by Rudyard Kipling are great for ideas. You can read "The Elephant's Child" story from Kipling's book about how the elephant got its trunk and then have students write their own stories about how animals got their unique features.

Research:
Students can research other animal classification systems or find other invertebrate classes that were not included on the chart in this lesson.

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ANIMAL KINGDOM

Animals can be classified into 2 groups. The Vertebrates are animals with a backbone. The Invertebrates are animals without a backbone. Run your hand down your back. Do you feel the bumpy bones? That is your backbone. You are a vertebrate.

There are 5 groups of Vertebrates:

- mammals – warm blooded animals that have hair or fur and are born alive.
- birds – warm blooded animals that have feathers and lay eggs.
- fish – cold blooded animals that have scales, gills, and fins and lay eggs.
- reptiles – cold blooded animals that have scales, and lungs and lay eggs.
- amphibians – cold blooded animals that have a smooth skin and can live on land or in water.

Warm blooded animals have a constant body temperature. Cold blooded animals have a body temperature that adjusts to the temperature of their environment.

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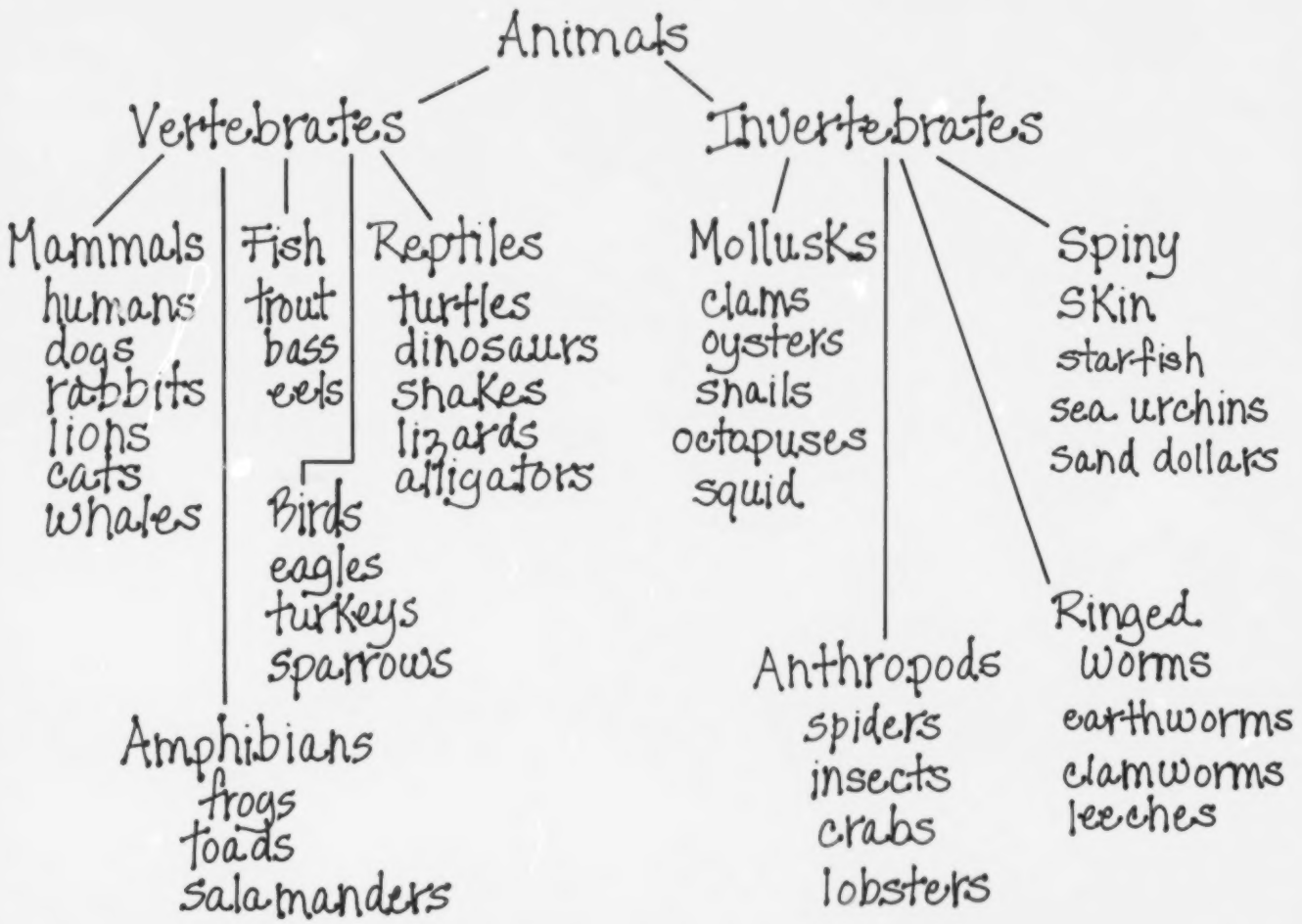
ANIMAL KINGDOM

There are many groups of Invertebrates. Here are four of the main ones.

- ringed worms – cold blooded animals that have a soft body with sections.
- echinoderms – cold blooded animals that have bodies with rough skin and sharp spines.
- mollusks – cold blooded animals with a soft body and sometimes a hard shell.
- arthropods – cold blooded animals with jointed legs.



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ANIMAL ANTICS

ALL AN

All Vertebrates

Mammals
1 point

Birds
2 points

Reptiles
4 points

Fish
3 points

Amphibians
5 points

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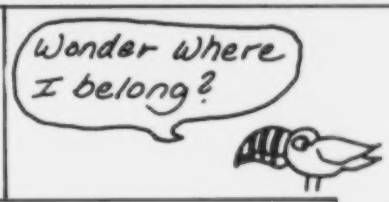
ANIMAL ANTICS

IMALS

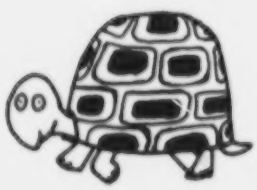
All Invertebrates



Mollusks
4 points

Echinoderms
3 points

Ringed Worms
1 point



Arthropods
2 points

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Animal Antics

Data Sheet

Team Members

_____

_____

_____

Prediction:

We think we will earn [ ] points.

All Animals	_____

All Vertebrate	_____
All Invertebrates	_____

				Points Earned
Mammals	_____	x	1 =	_____
Fish	_____	x	3 =	_____
Birds	_____	x	2 =	_____
Reptiles	_____	x	4 =	_____
Amphibians	_____	x	5 =	_____
Ringed Worms	_____	x	1 =	_____
Mollusks	_____	x	4 =	_____
Arthropods	_____	x	2 =	_____
Echinoderms	_____	x	3 =	_____

TEAM TOTAL [ ]

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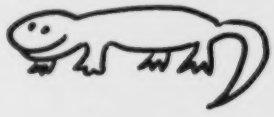
Name _____

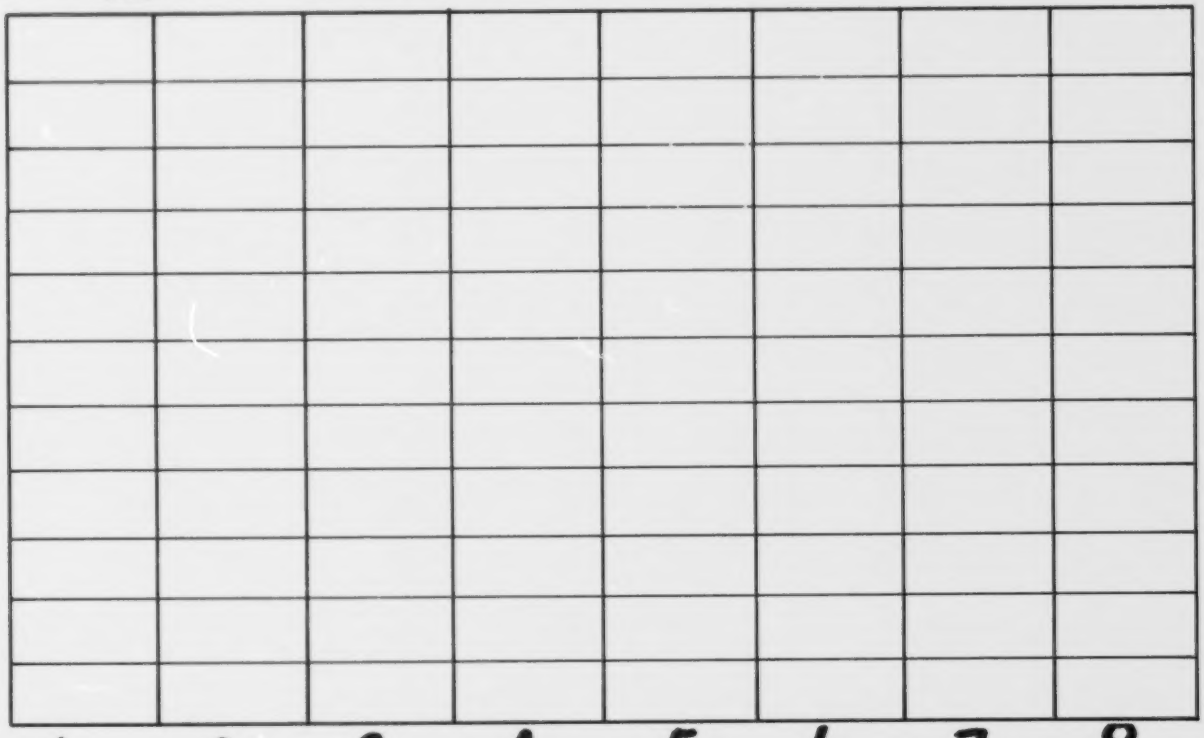
Finding the Animal Antics Winner

Record the scores:

Team	1	2	3	4	5	6	7	8
Score								

Now graph the scores:





Winning Team →

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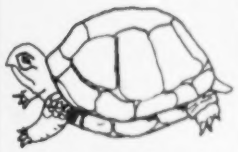
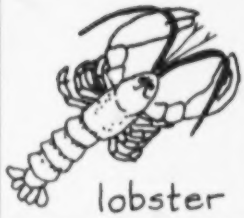
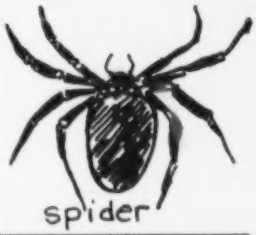
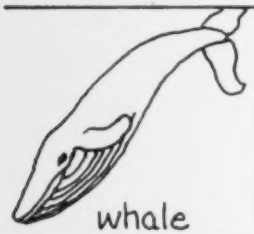
Elephant


turtle

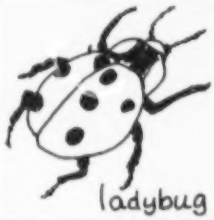
butterfly


lobster

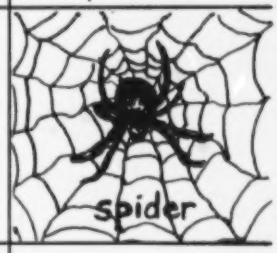

spider


whale

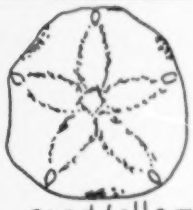
alligator

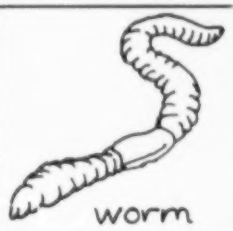

ladybug

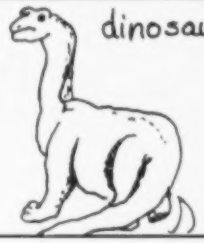
crab


spider

parrot


sanddollar

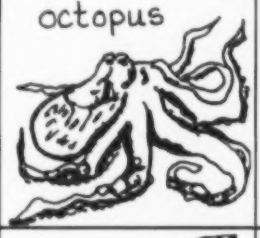

worm


dinosaur

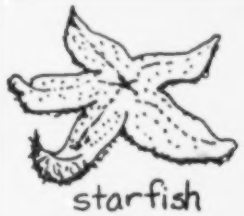
worm

bird

frog


octopus

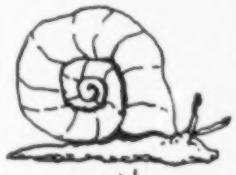
clam


starfish

fish

toad

squid


snail

bee

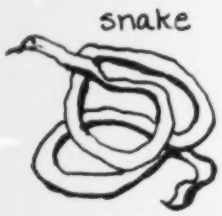
fish

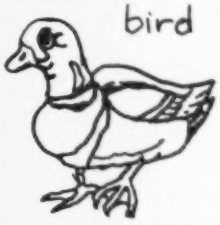
salamander

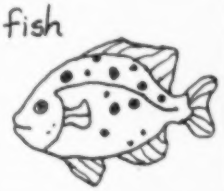
grasshopper

snake

frog


snake


bird


fish

bear

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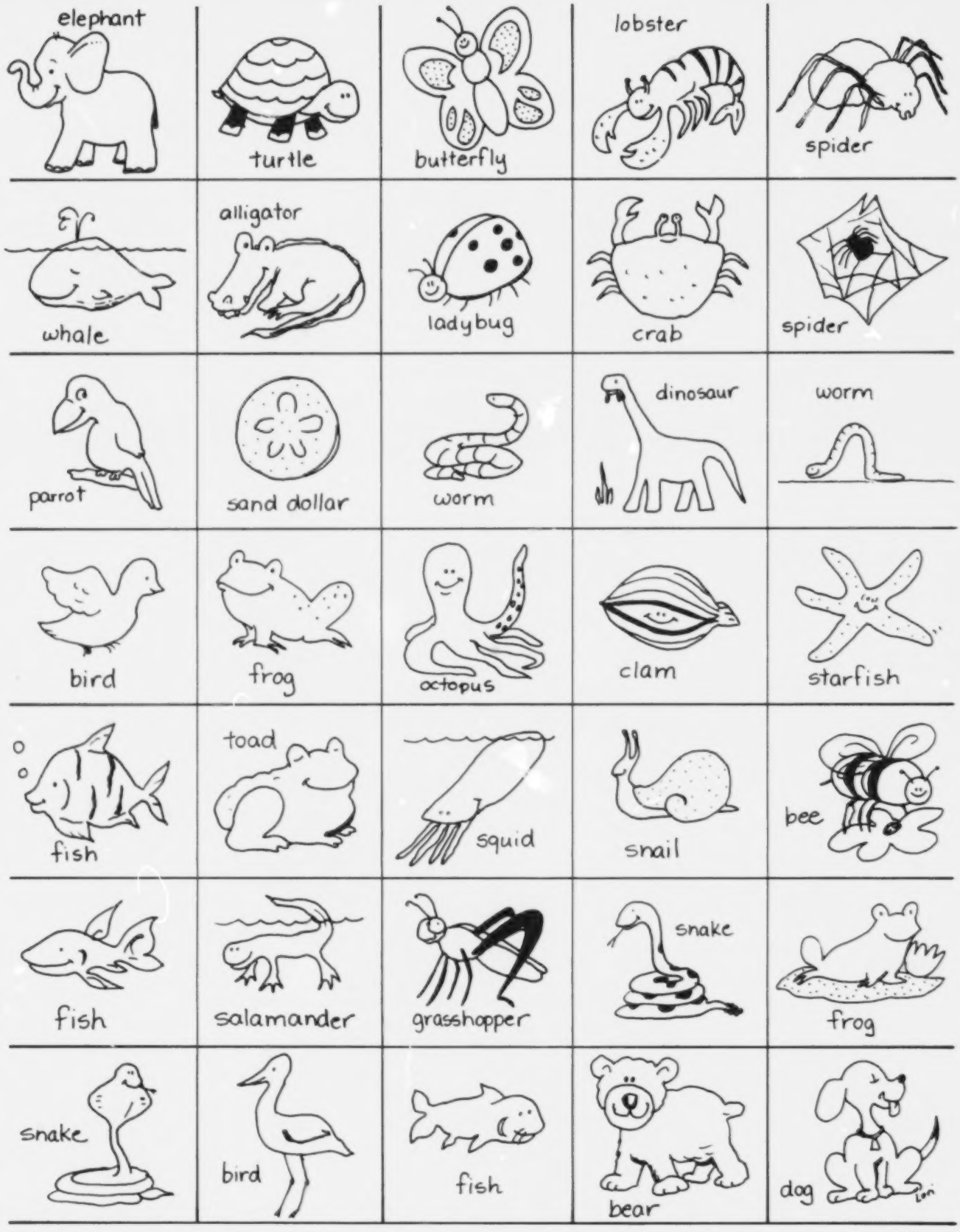

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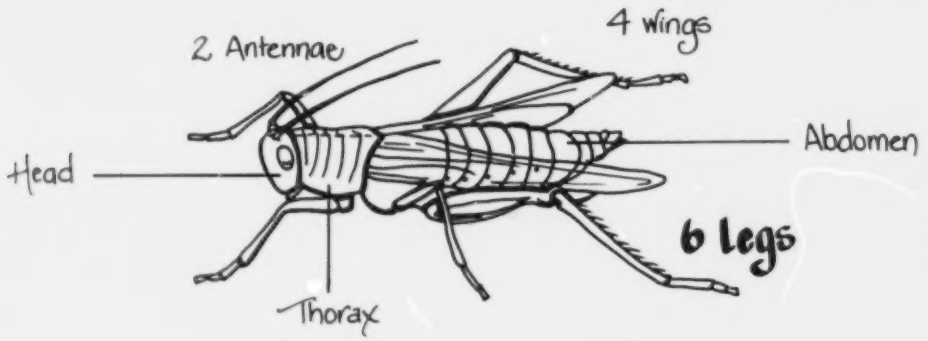
Insects

The major role of the insect is pollination, which is very necessary to the plants and animals of the earth. Insects also eat other insects, carry disease and can cause destruction of crops and whole fields.

Insects have been on earth for over 300 million years. There are more insects than all other animals put together.

Insects belong to the class Insecta, among the Arthropods. Arthropoda means "jointed legs". Their relatives are spiders, crabs and lobsters, and centipedes and millipedes.

Insects have three body parts: the head, the thorax or chest, and the abdomen or hind body. They have six legs. Most insects have wings and two compound eyes, though there may be a number of small simple eyes. Most have antennae for smelling. Insects have a hard exterior skeleton, or exoskeleton.



Most insects go through a life pattern called metamorphosis: caterpillar to moth, or maggot to fly. There are four major groups of insects: BEETLES, BUTTERFLIES and MOTHS, WASPS, BEES and ANTS, FLIES, MOSQUITOS and GNATS. "Entomologists" study insects, and have probably discovered and identified only about half of these important creatures.

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The major role of the spider is to eat insects. Every year they do away with millions and millions of insects that destroy grain crops and eat green leaves. Most spiders are timid, harmless, and quite helpful. The two spiders to watch out for are the black widow and the brown recluse spider, which are harmful to humans.

Spiders have been on earth for hundreds of millions of years. They are numerous, and found everywhere except Antarctica.

More than 30,000 different species are known. Over 2,000 of these live in the United States.

Spiders belong to the Arthropoda class like insects. Their family is Arachnida and the order of spiders is Araneae. The word Arachnida comes from a Greek myth. Arachne lived in Greece many centuries ago. Her spinning and weaving was so skilled, that she challenged Athena, the goddess of weaving and handicrafts, to a contest. Her tapestry was so perfect that, according to the story, Athena became enraged and turned her into a spider, condemning her to perpetual spinning. Our word 'spider' comes from the German word 'spinner', meaning one who spins.

Spiders have an exoskeleton like insects. They have eight legs. The spider's body has two parts: the head and thorax (cephalothorax) are one part, the abdomen is the second. There are no wings and no antennae or feelers. A spider usually has eight simple eyes. Spiders molt (shed their outer covering) during growth, rather than go through a metamorphosis. Most live about one year, but tarantulas may live 20 years.

A spider does not chew its food. It paralyzes or kills its prey with its fangs and then a digestive juice turns the tissues into a liquid which is then sucked into the spider's stomach.

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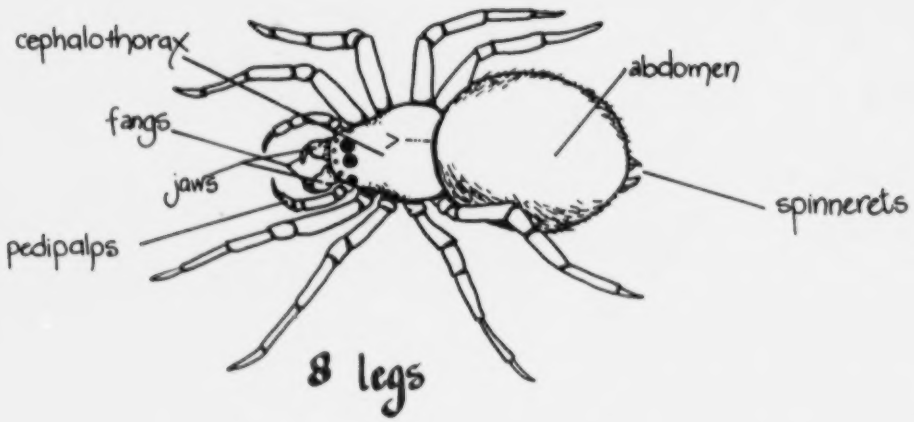

Spiders produce silk from glands in their bodies. As the liquid shoots out of six spinnerets and is exposed to the air, it hardens. The spinnerets control and shape the silk which can be thin, thick, dry, sticky, soft, stretchy or beaded. The spider uses the silk for webs, traps, nests, to wrap, and also as a dragline. Females wrap their eggs with silk. Spiderlings release silk and use it to carry themselves in the wind. This is called ballooning.

Spider silk has been used by primitive people for fishing nets, lures, bags, and headdresses. The silk has also been used as cross hairs in astronomical telescopes, levels, and surveying equipment.

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WINGS 'N WEBS

I. Topic Area
Insects and spiders

II. Introductory Statement
Students will learn external differences in the bodies of insects and spiders by observing and constructing.

III. Math Skills
a. Tables
b. Counting
c. Whole numbers
d. Graphing

Science Processes
a. Observing
b. Collecting and recording data
c. Organizing data
d. Drawing conclusions
e. Generalizing
f. Comparing

IV. Materials
An insect and spider for each group (the pictures provided in this investigation may be used if necessary).
Hand lenses
Pipe cleaners — ten pieces two inches long for each student
Tooth picks — five per student
Clay — 50 grams per student
Construction paper — 3"x3" per student, any color
Scissors
Activity sheets

V. Key Question
What are the external differences between the bodies of insects and spiders?

VI. Background Information
See data sheets.

VII. Management Suggestions
1. Each group of children needs an insect and a spider. It is very important that "real" specimens be provided by teacher or students. If this is not possible, fill in with the pictures provided in the investigation.
2. Work in groups of 4–5 students.

VIII. Procedure
1. Divide students into groups of 4 or 5.
2. Give each group a spider and an insect. If these are not available give each group a picture of each.
3. Each student is given activity sheets.
4. Each student will record the name of the insect and spider used in his group.
5. Students will compare the insect and spider and record observations on the table.
6. The class will discuss findings.
7. All students will write a sentence or two about the differences observed.
8. Now that students know some of the differences, they will finish the drawings.
9. Students will each make an insect or spider out of clay, tooth picks, pipe cleaners, and construction paper.
10. Students will make a drawing of their creation, label it a spider or insect, and name it.
11. Students will guess each other's creation and record on table.
12. Class will build a real graph on the floor of spiders and insects using their own creations, and then make a block graph of their own.
13. Discuss.

IX. Discussion Questions
1. What are the differences in the bodies of insects and spiders?
2. Have you seen creatures which are not insects or spiders but which appear very similar?

X. Extended Activities
1. Collect insects and spiders and identify.
2. Make a booklet of one spider or insect.

XI. Curriculum Coordinates
1. Creative Writing: Write a make-believe story about a spider or insect.
2. Geography: What is the territory of certain insects or spiders?
3. Literature: Books to read — Anansi Tales and Charlotte's Web.
4. History:
   a. How are spiders and insects used to represent good and evil in past civilizations?
   b. How have insects caused crop damage and to what historical significance?
   c. Why do states inspect fruits and vegetables at borders?

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Wings 'n Webs

Name _____

COMMON NAME OF YOUR INSECT: _____ SPIDER: _____

	INSECT	SPIDER
Number of legs		
Number of body parts		
Number of wings		
Number of eyes		

OBSERVATIONS: _____

_____

_____

FINISH THE DRAWINGS and TELL WHAT THEY ARE

_____ _____

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Wings 'n Webs

Name _____

1. Make an insect or a spider out of clay, toothpicks, pipe cleaners, and construction paper. Don't tell anyone what it is.

2. DRAW IT:

What is it? _____ Give it a name: _____

3. Guess what each person in your group made:

Name of Group Member	Prediction: INSECT	Prediction: SPIDER	Actual: INSECT	Actual: SPIDER

How many did you guess correctly? _____

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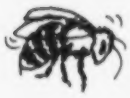
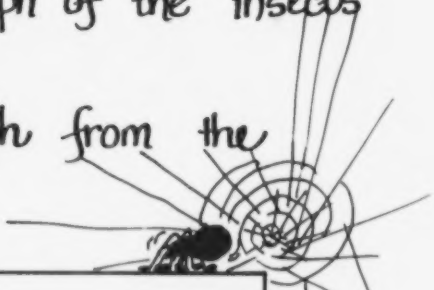
Wings 'n Webs

Name _____

4. Make a whole class floor graph of the insects and spiders that you made.

5. Now make your own bar graph from the floor graph.





Number of Creatures

	INSECTS	SPIDERS
23		
22		
21		
20		
19		
18		
17		
16		
15		
14		
13		
12		
11		
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		

Type of Arthropod

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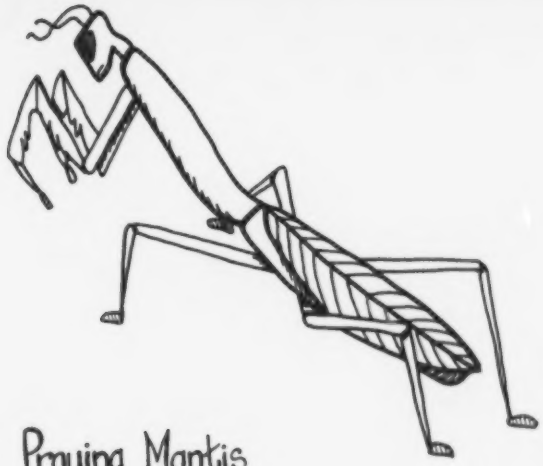
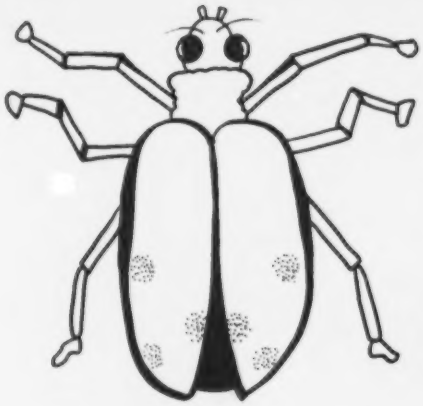
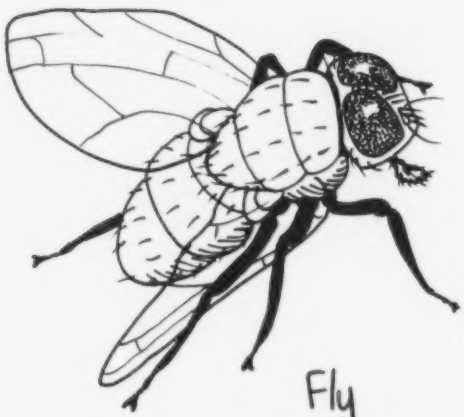


Praying Mantis



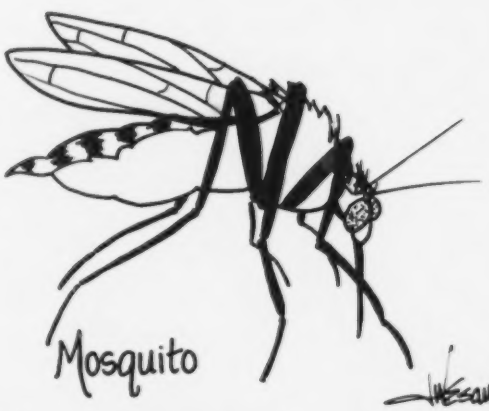
Tiger Beetle



Fly

Potter Wasp

cricket



Mosquito

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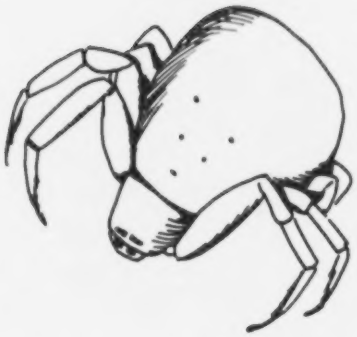
Black Widow Spider

Tarantula



Crab Spider

Jumping Spider

Wolf Spider

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POPPING THROUGH THE GARDEN

I. Topic Area
Spider and insect differences

II. Introductory Statement
Students will make a pop-up spider and insect, identifying the body parts of each.

III. Math Skills
a. Counting

Science Processes
a. Observing
b. Classifying

IV. Materials
"Build a Spider and Insect" page for each student (there are two versions, one for younger students with the body parts already connected and one for older students)
scissors
glue
insect and spider fact sheets from "Wings 'N Webs"
blank paper
"Moth and Butterfly" page for each student (optional for extension activity)

V. Key Question
What are the differences between a spider and an insect?

VI. Background Information
See student fact sheets in "Wings 'N Webs"

VII. Management Suggestions
1. Teacher can write in labels on spider and insect bodies if desired.
2. This is a cooperative learning lesson. Each group will need a reader and recorder.
3. Accordion folded strips are mounted on the underside of the spider and insect creating the pop-up effect. **Note:** there are more legs than needed in each pop-up.
4. **Primary Note:** A simpler spider and insect cut out page is given with the correct number of legs for each.

VIII. Procedure
1. Make a list of all the differences between spiders and insects that are known by the class on the chalkboard. Accept all statements, even incorrect ones.
2. Form cooperative learning groups. Give each team the "Wings 'N Webs" fact pages. They are to find additional information to add to the class list (1 point for each item). Recorder records the facts for the team. Check the list for errors (1 point for each error discovered).
3. Points per team are determined.
4. See discussion questions #1–2.
5. Using the information gained, and the parts page, students will make a pop-up spider and a pop-up insect, labeling each part.
   a. select and cut out parts to be used
   b. label parts
   c. glue or tape parts together
   d. cut out accordion strip — fold on lines
   e. attach one end of strip to underneath of critter
6. On blank paper, draw an environment fit for the insect and the spider, include a web for the spider.
7. The spider and insect are then mounted on the environment page by attaching the accordion strip to the paper.

IX. Discussion Questions
1. What differences can be added to our list?
2. Why are spiders and insects in the same animal classification group? (They have segmented bodies.)
3. What parts did you have to pick in order to build the spider and to build the insects?

X. Extended Activities
1. Discuss the differences between butterflies and moths. Make a pop-up butterfly and moth.
   a. Wings — A butterfly's wings are held upright at rest; a moth folds its wings down against its body or holds them straight out to the sides.
   b. Antennae — A butterfly has knobs at the end; a moth has feathery antennae.
   c. Body — A butterfly's body is pinched in the middle and slender; a moth's body is shorter and plump.
2. Study the life cycle of butterflies or moths by actual observation. This metamorphosis can be recorded by using the "Metamorphosis Wheel" from the mealworm lessons. Students can draw each stage of the metamorphosis by observing the class collection of butterflies or moths.
3. Make a bulletin board to house all your insects and spiders.
4. Make additional insects using optional parts.

XI. Curriculum Coordinates
Language:
Write a descriptive story about your spider or insect.
Research/Art:
Find our how insects and spiders camouflage themselves and color your insect or spider accordingly.
Art:
Using yarn and popsicle sticks (or branches) — weave a web.

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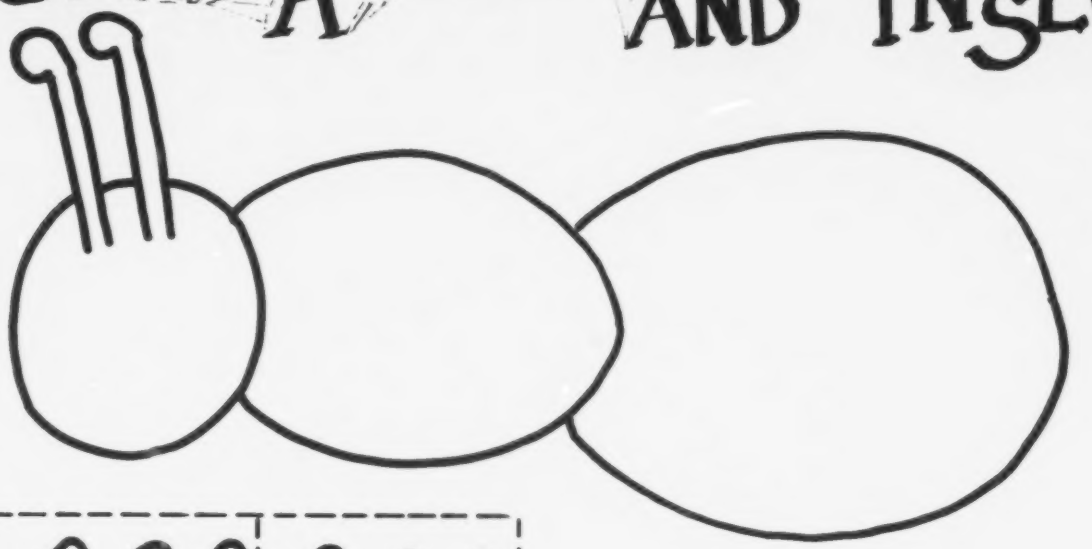
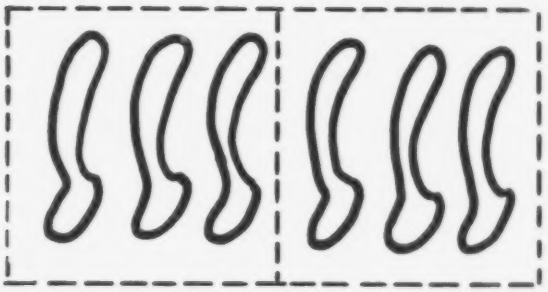
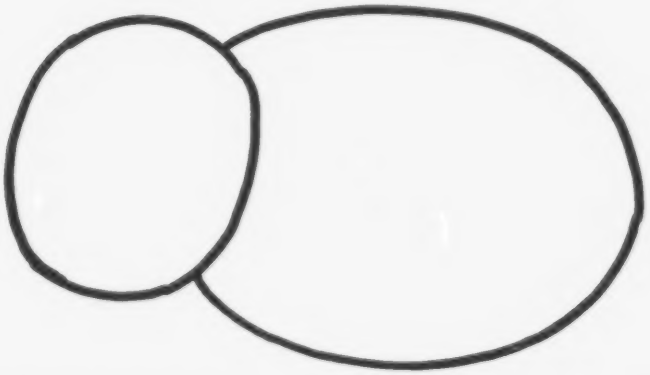
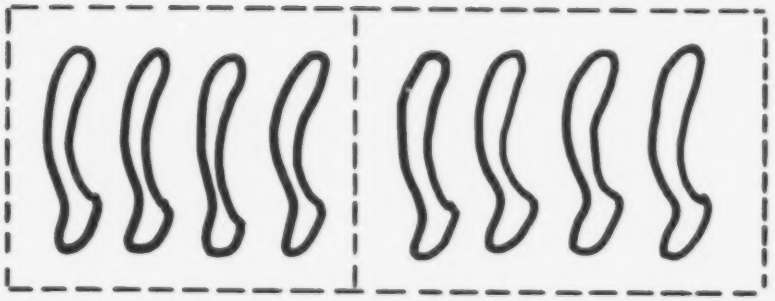
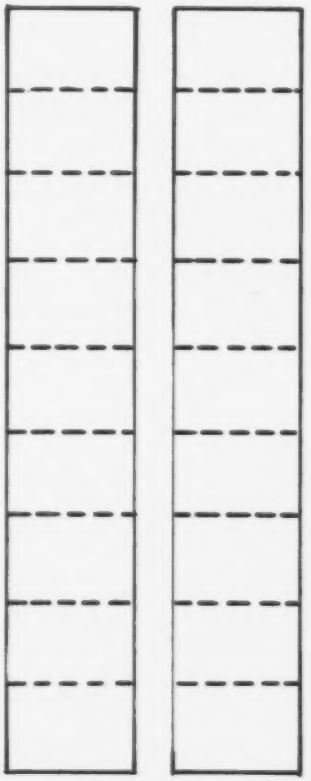
BUILD A SPIDER AND AN INSECT











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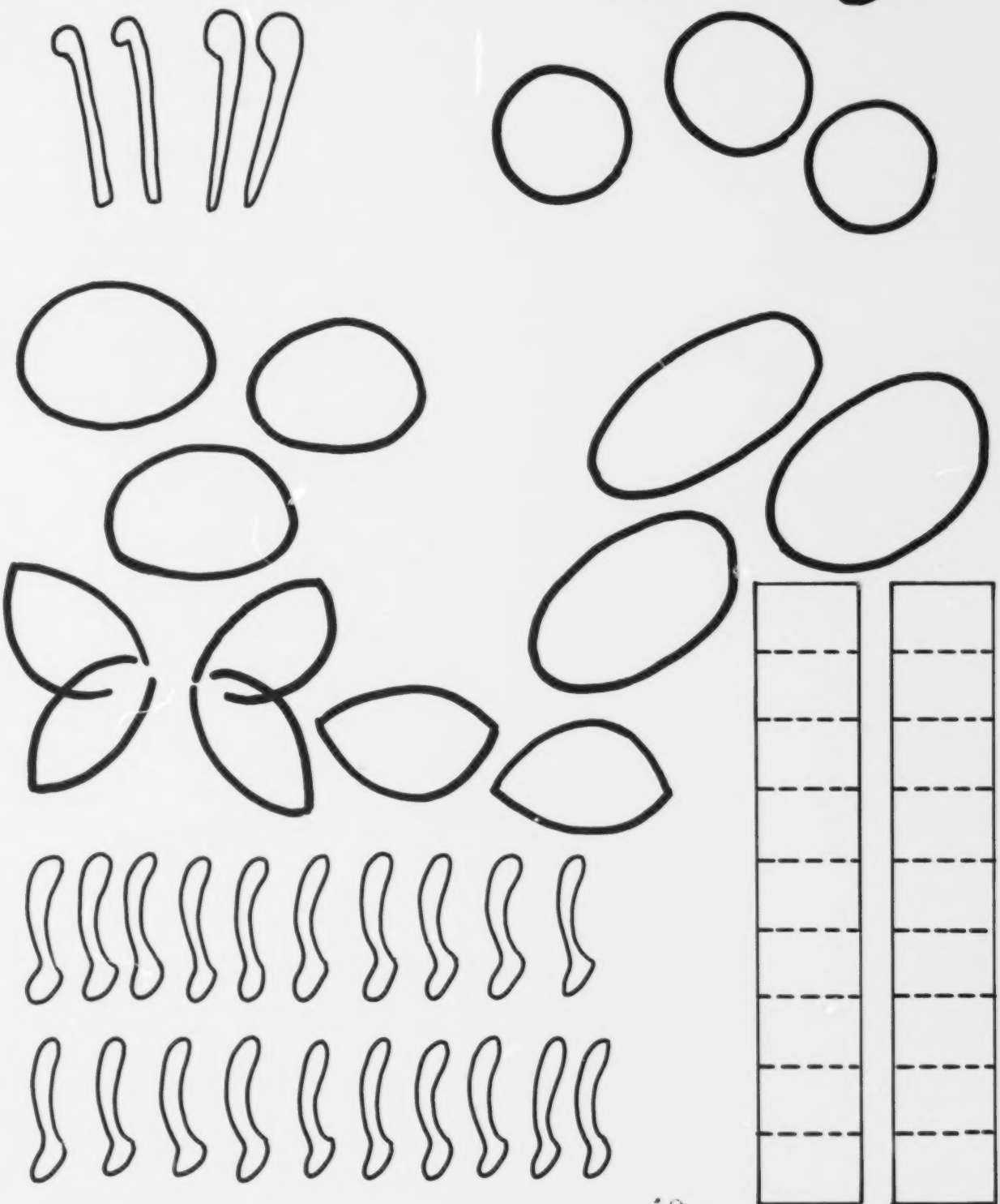
BUILD A SPIDER AND AN INSECT



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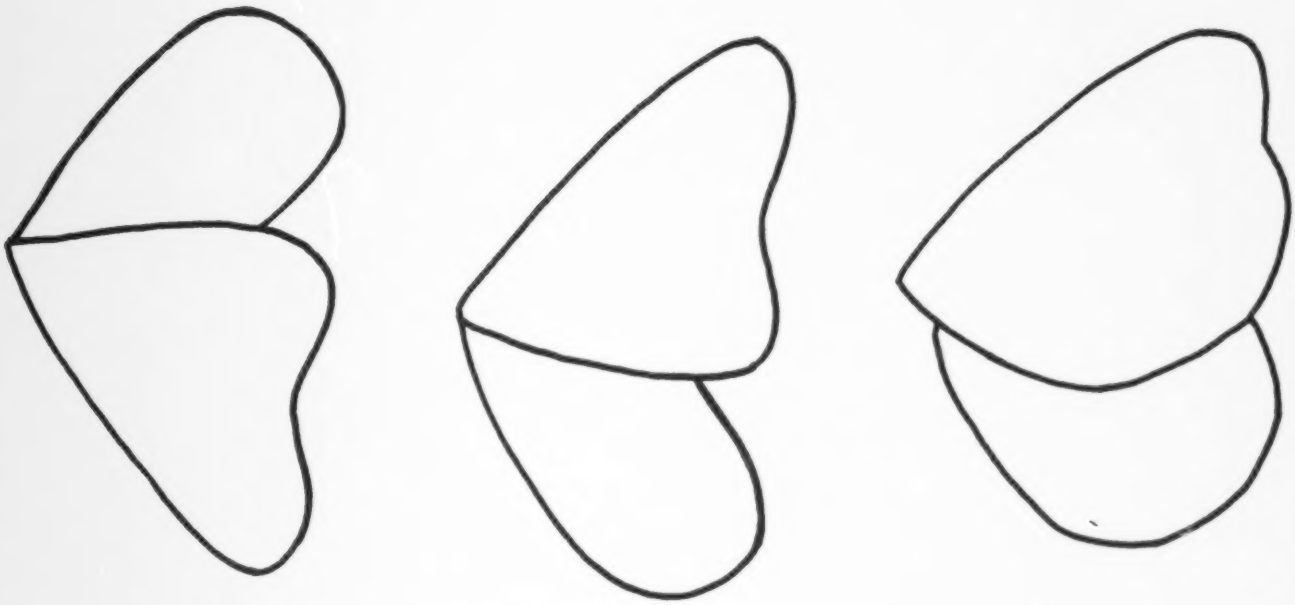
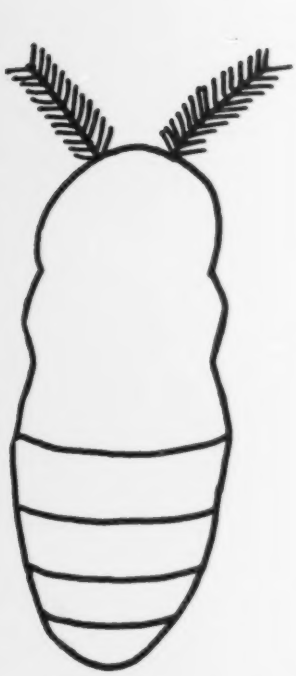
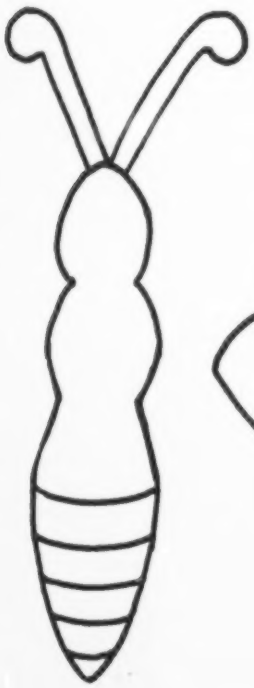
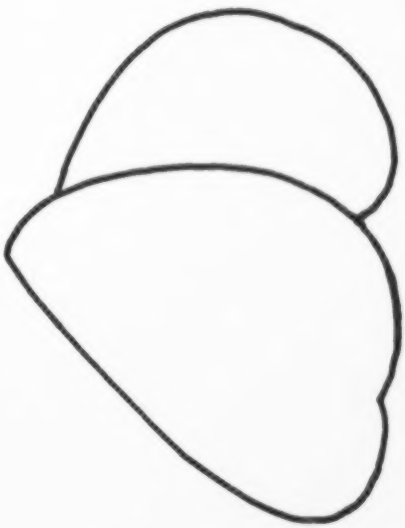
Build a Butterfly and a Moth









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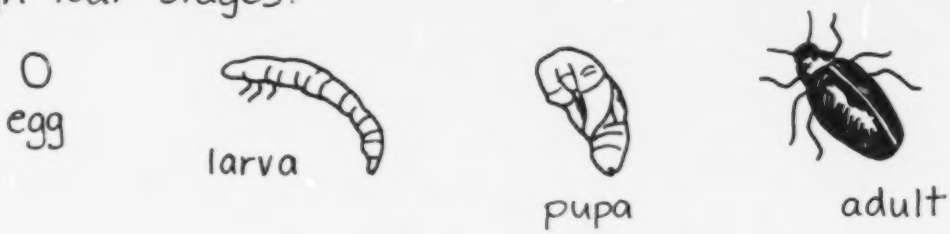
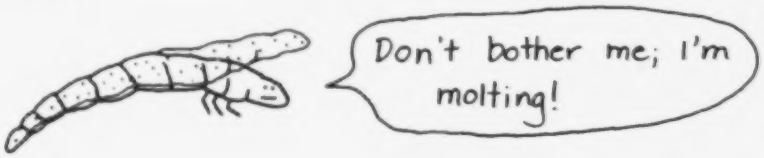
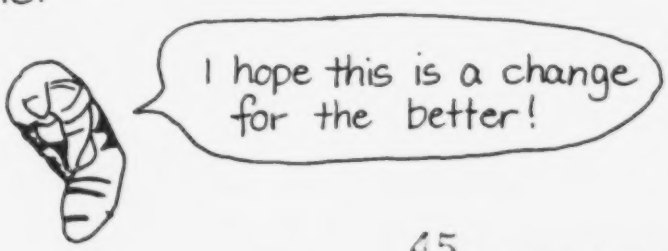
Many insects go through four stages of growth. The changes that occur in their life cycle are called metamorphoses. Metamorphosis is a Greek word that means to transform or change. In complete metamorphosis the insect goes through four stages.



Mealworms are the larval stage of grain beetles. The life cycle begins with white oval shaped eggs that are about 1 mm long. The eggs usually hatch in about one week. After hatching, the larvae (mealworms) begin to eat. They eat grains and soon become too large for their hard skin. The larval stage lasts for 2 to 3 weeks. The mealworm sheds its skin several times before it begins the pupa stage. Shedding its skin is called molting.



The pupal stage lasts for about 1 to 3 weeks. While in the pupal stage the larva transforms into the adult beetle.



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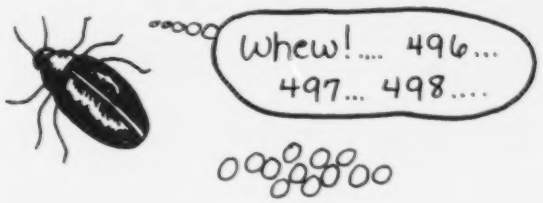
When the adult comes out of the pupa case it is white. It gradually turns brown and finally black. The adult has wings but cannc' fly. It can hop about 10-12 cm. The adult beetle lives only a few months. The female may lay up to 500 eggs before it dies, and the life cycle starts all over again.



Mealworms are usually found in dark damp places. They are scavengers who like to eat rotting grain and cereal. They will eat grain, cereal, flour, bran, bread, crackers, meat scraps, feathers and the bodies of dead insects.

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MY MEALWORM

I. Topic Area
Mealworms

II. Introductory Statement
Students will use science process skills to become familiar with mealworms and their life cycles.

III. Math Skills
a. Measurement

Science Processes
a. Observation
b. Classification
c. Manipulating variables
d. Inferences

IV. Materials
mealworms
plastic shoebox or other container for classroom mealworm home
cereal or grain
"My Mealworm" booklet for each student

V. Key Question
What do you know about mealworms?

VI. Background Information
See the mealworm fact pages.

VII. Management Suggestions
1. Get a supply of mealworms for your classroom from a pet store and put them in a container with some damp cereal in it.
2. To make the "My Mealworm" booklet, collate the three activity pages, fold in half, and staple along the fold.
3. This can be a multiple lesson activity.
4. Allow students to familiarize themselves with their mealworm before beginning the lesson.
5. Students can keep their mealworm at their desk in a small plastic container (cottage cheese, yogurt, etc.) with holes in the lid. Some damp cereal inside will provide food and cover for the mealworm.

VIII. Procedure
1. All students receive a mealworm and a copy of the "My Mealworm" booklet.
2. Students draw a picture of their mealworm on the cover of the "My Mealworm" booklet and give it a name.
3. Students observe their mealworms using as many senses as possible and record their observations on the observation page.
4. Students measure their mealworm and compare its length to other things that are longer or shorter. Record this data on "Mealworms Measure Up" page using words and/or pictures.
5. On the center pages, which are blank, students can write and/or illustrate a story about their mealworm. Suggested topics are: "A day in the life of my mealworm", "If my mealworm could talk", poems about mealworms.
6. Read and discuss "Mealworms on Stage" fact page.
7. Students draw and label the four stages of the life cycle on the opposite blank page.
8. Observe all mealworms in the classroom mealworm container and classify them as larvae, pupae or adults. Count the numbers of each and record this information on the classification chart in the booklet. This can be repeated every two weeks and the data can be compared and analyzed. Note: This activity may be postponed until after the life cycle has progressed (several weeks).
9. On the blank page have the students draw a natural environment for mealworms.
10. Perform the three tests on the "Watch Your Mealworm" page. Record your observations.

IX. Discussion Questions
1. Are mealworms worms?
2. Are all mealworms alike?
3. How are your mealworms alike?
4. How are they different?
5. What affects a mealworm's behavior?
6. What does a mealworm eat?

X. Extended Activities
1. Find the longest mealworm in the class.
2. Add additional pages to the booklet with comparisons, graphs, etc. on observations and measurements made.
3. Put some food on one side of a container and your mealworm on the other side and find out how long it takes to find the food.

XI. Curriculum Coordinates

Language Arts:
Continue creative writing and poetry on the mealworm and its life cycle.

Art:
Design a luxury home for your mealworm.

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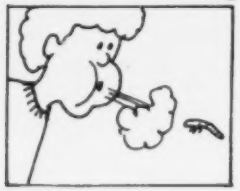
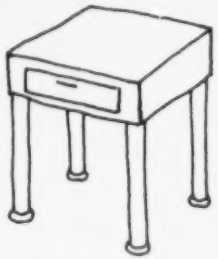
Watch your mealworm.
Record your observations.

① Blow on your mealworm.



② Tap on the desk next to the mealworm.



③ Drop water on the mealworm.

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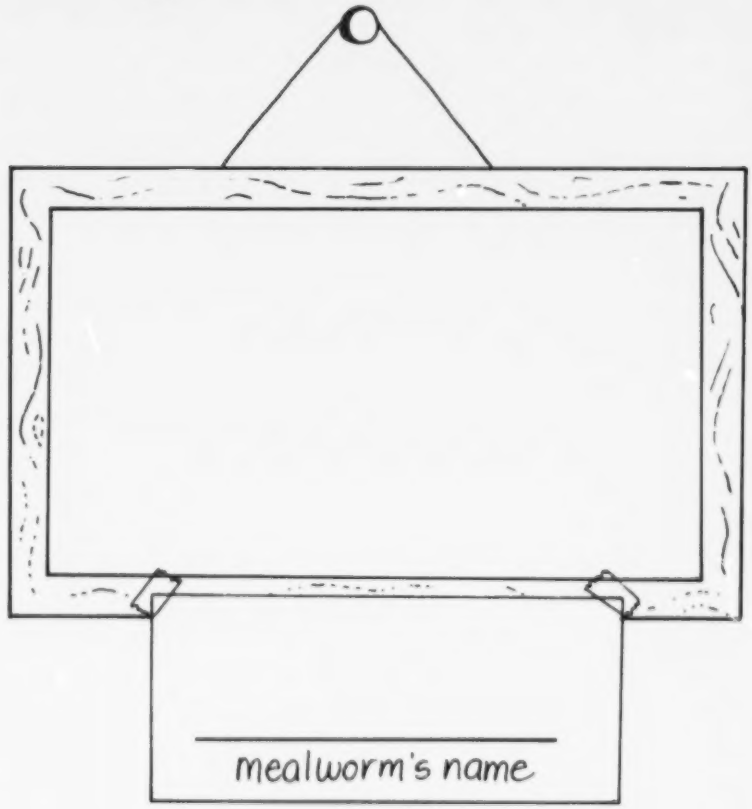
My Mealworm



mealworm's name

By _____

Classify all the mealworms in the container.

	larvae	pupae	adults
week 1			
week 3			
week 5			
week 7			

Draw a natural environment for your mealworm.

Did you ever see a mealworm go this way and that way.... go this way and that?

Observe your mealworm carefully!

Observation:	Sense used:
1.	
2.	
3.	
4.	
5.	

Which sense did you use most? _____

Now, use other senses...

Observation:	Sense used:
1.	
2.	
3.	

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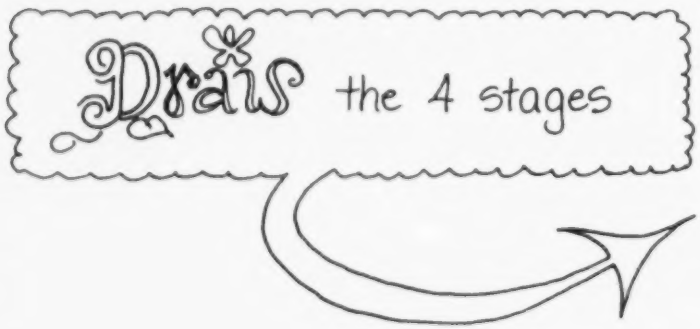
Mealworms have a 4 stage life cycle. They begin as tiny eggs that we can't see. The second stage is the larva or mealworm stage. Next they begin their metamorphosis and become a sleepy pupa. Finally they become a black beetle (the adult stage).



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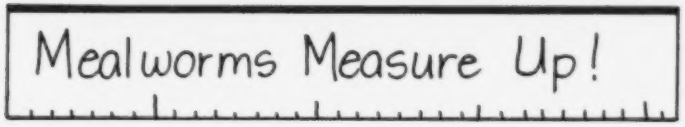
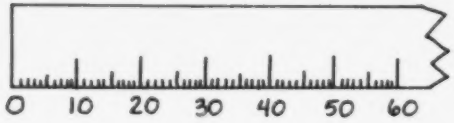


Now that you and your mealworm are friends, it's time to measure up...

* My mealworm measures _____ mm.



Items longer than my mealworm	Items shorter than my mealworm

MEALWORMS ON STAGE

I. Topic Area

Mealworm populations

II. Introductory Statement

Students will observe and record data for a changing population of mealworms.

III. Math Skills

a. Graphing
b. Counting

Science Processes

a. Observation
b. Classification
c. Manipulating variables
d. Inferences

IV. Materials

class culture of mealworms
both "Mealworms on Stage" activity sheets for each student
Note: Students will need four copies of the first activity sheet (for group results), one for each week

V. Key Question

How will a mealworm population change over a period of four weeks?

VI. Background Information

See the mealworm fact pages.
To make a classroom culture you will need mealworms, oatmeal or bran, a plastic container and a potato. Add the bran or oatmeal to the container to form a layer two to three inches deep. Put in a supply of mealworms and both halves of a potato. A cover is not necessary.

VII. Management Suggestions

1. Buy some mealworms from a pet store and begin a class culture about two weeks before you collect the first data.
2. Make a large copy of the data table and post it on a wall above the mealworm culture.
3. Decide what day of the week you will do your population counts.
4. Make sure that students know how to identify each stage of the mealworm's life cycle.
5. Allow time for the students to observe the mealworms before beginning the population count.

VIII. Procedure

1. Each group scoops up a portion of the mealworm population to count. Make sure that all the mealworms are taken from the class culture.
2. Each group will classify their sample according to life stages and count the number of mealworms at each stage. This information will be recorded on the first page (group results page).
3. Each group will report their data and all students will fill in the data in the appropriate space on the first page.
4. After each group has reported the numbers of mealworms at each stage, students should add the columns to find the total number of mealworms in the class culture at each stage.
5. The class totals should then be recorded on the second activity sheet and the line graph begun.
6. This activity will be repeated three more times at week intervals. Each time students will need a new copy of the first activity sheet to find the group and class totals. The second activity page should be continued each week. At the end of four weeks the chart and graph will be complete.

IX. Discussion Questions

1. How many mealworms were at each stage in the life cycle?
2. How did these numbers change from the previous observation?
3. Are there any patterns in the mealworm's life cycle that can be determined from this activity?
4. Can you determine the length of each stage in the mealworm's life cycle?

X. Extended Activities

1. Continue the activity for longer than four weeks and see if any long term patterns in the mealworm's life cycle emerge.
2. Find the mass of the potato each week and explain the changes.
3. Devise a way to accurately determine the length of each stage in the mealworm's life cycle.
4. Make the "Metamorphosis Wheel" depicting the mealworm's life cycle.

XI. Curriculum Coordinates

Language Arts:

Pretend you are in the pupae stage and tell what it is like to go through metamorphosis.

Math:

Convert the numbers on the chart to percentages.

Science:

Make a list of other insects that go through a complete metamorphosis.

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MEALWORMS ON STAGE

Group Results Page

Week	# of Larvae	# of Pupae	# of Adults

Class Total for Week

Team	Larvae	Pupae	Adult
1			
2			
3			
4			
5			
6			
7			
8	+	+	+
Totals			

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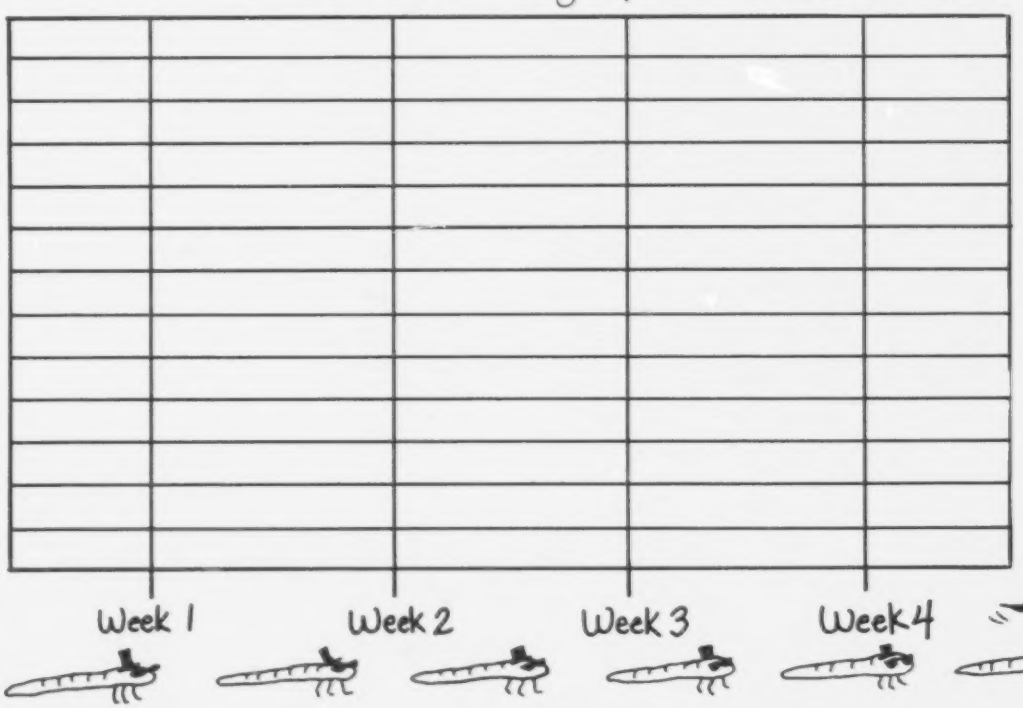
MEALWORMS ON STAGE

Record your mealworm population each week.

Week	Larvae	Pupae	Adult
1			
2			
3			
4			

① Complete the color key
② Make a line graph for each week



Key

☐ larvae

☐ Pupae

☐ Adult

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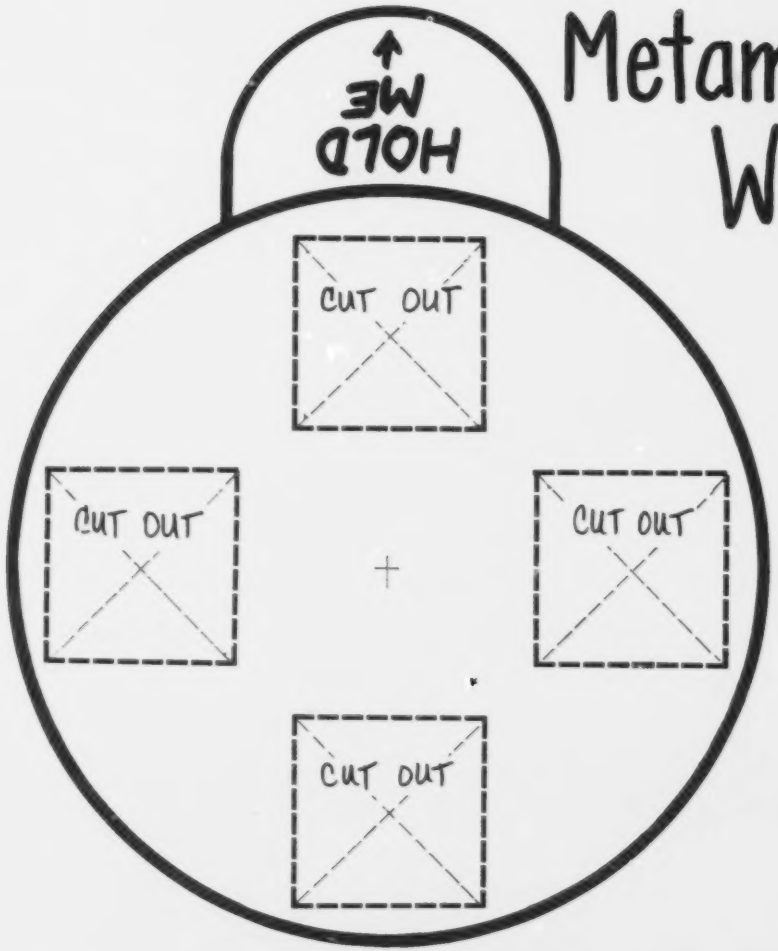
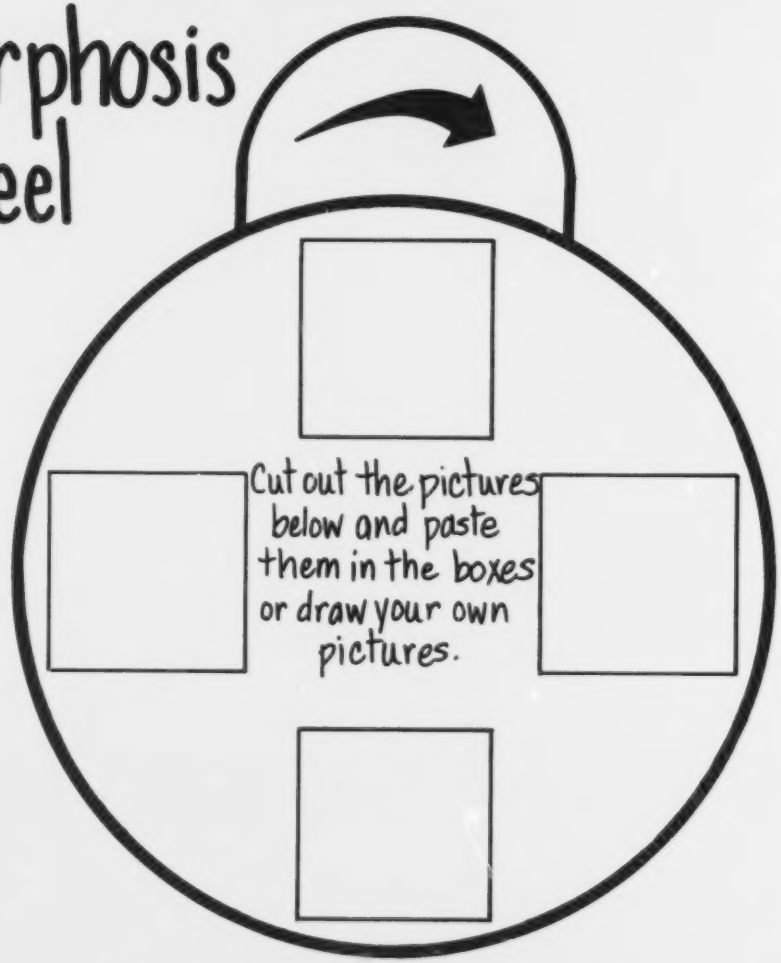
Metamorphosis Wheel





Incomplete Metamorphosis

Incomplete Metamorphosis	0 egg	nymph	adult

57

Complete Metamorphosis

0 egg	 larva	 pupa	 adult

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58

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EARTHWORMS

Earthworms are often called "Nature's Plowman" because they live in the ground and tunnel their way through the ground mixing up the different layers of the soil.

WHAT DO EARTHWORMS EAT?

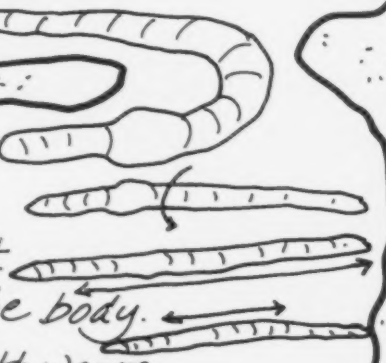
Earthworms eat decayed leaves and plant material. They also swallow soil and little bits of animal material.

HOW DO EARTHWORMS MOVE?

Earthworms have 2 sets of muscles:

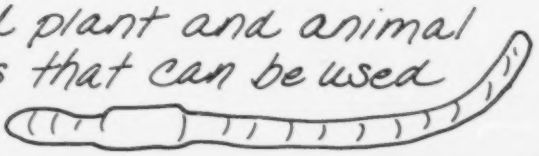
1. Circular Muscles around each segment.
2. Long Muscles that run the length of the body.

When the circular muscles tighten, the earthworm becomes longer and thinner. When the lengthwise muscles tighten, the earthworm becomes shorter & fatter.



HOW DO EARTHWORMS HELP THE SOIL?

1. They mix up the different layers of the soil.
2. They add nutrients to the soil by depositing their waste products or "castings" into the soil.
3. They help to decompose dead plant and animal material into simpler parts that can be used again by new organisms.



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THE EARTHWORM

I. Topic Area
Earthworms

II. Introductory Statement
Students will observe an earthworm and its habitat. They will make an earthworm book recording their observations.

III. Math Skills
a. Measurement

Science Processes
a. Observing
b. Collecting & organizing data

IV. Materials
earthworms
paper towels
magnifying glasses or hand lenses (optional)
activity sheet
scissors and tape
one large jar
black paper to wrap around jar
plastic wrap
soil, sand and gravel
grass roots or decayed leaves

V. Key Question
What do you know about earthworms and their habitat?

VI. Background Information
Earthworms are invertebrates. They are extremely important ecologically. They burrow through the soil increasing its porosity and allowing air and water to penetrate it more easily. At the same time the soil is enriched as the earthworms carry surface materials into deeper layers. Earthworms are also food for many birds, mammals and reptiles.

The earthworm's body is made up of many segments which appear as rings. It may have as many as 100–200 segments. Older worms have more segments than younger worms. The segment that is specialized for reproduction is larger and lighter colored than the rest of the segments and is located about a third of the way from the front of the worm. The head is the thicker of the two end segments located on the end closest to the reproductive segment. Although the head has no eyes or ears, it contains a mouth and a very sensitive nose for smelling decaying organic material which is the worm's food source. Worms have a very sensitive skin that responds to temperature, touch and light. To eat, the worm takes in soil, separating the nutrients from the non-organic material. This material is separated from the soil in the worm's stomach. The worm then passes the soil, which has been ground down in its gizzard, through its body and back into the ground in the form of worm casts. These worm casts act as fertilizer and enrich the soil. Worms are hermaphrodites, which means that they carry both eggs and sperm and can play the role of either male or female in mating and reproduction.

VII. Management Suggestions
1. Earthworms can be bought in bait stores or found by digging in moist earth. After a heavy rain they can be picked up off the sidewalks at school where they go to avoid drowning in the waterlogged soil.
2. Each child can have a worm or teams of two to four can observe one worm. The worms can be placed on paper towels for easy viewing.
3. Students will fill in the sections on the activity sheet after spending time observing the worms. The sheet can then be cut in two and taped together to make a single long strip which will fold along the dotted lines to form an accordion style book.
4. One large worm habitat or "worm hotel" can be built by the class to store all the worms. The soil must be slightly moist, but not waterlogged.

VIII. Procedure
1. Hand the worms out on paper towels for students to observe.
2. Students share their observations.
3. Challenge students to find the mouth of their worms and have them observe the wide, lighter colored band where the eggs are kept.
4. After sufficient time observing, have students draw a picture of their worm on the activity sheet.
5. Have students see if they can locate any ears or eyes. They can then answer the two questions on the activity sheet. It may be appropriate to inform students that the skin of a worm is very sensitive and senses light and vibrations (sound). It acts as the worm's ears and eyes.
6. The class "worm hotel" can then be built using the large glass jar and filling it with layers of moist sand, soil and gravel. Each layer should be wide enough to be distinct. Students can gather grass roots and decayed leaves to put on top of the soil. At this time the worms should be placed in the jar.
7. When this is done the students can help measure and cut a piece of black butcher paper to cover the sides of the jar. This cover can be taped in place. The mouth of the jar can be covered with plastic wrap that has holes poked in it for air. This cover will help the soil retain its moisture and keep the worms in their hotel.
8. The hotel can then be put aside and the students can make their worm book by cutting the page in half and taping it together, then folding it accordion style into a booklet.
9. After five days the worm hotel can be uncovered and observed. The students can draw a picture of what the worm hotel now looks like on the last page of their worm booklet.

IX. Discussion Questions
1. How can you tell which end of the worm is the head?
2. Can you observe the lighter colored wide band on your worm that holds the eggs?
3. Why do you think worms come to the surface after a heavy rain and crawl on the sidewalk?
4. Worms are one of the most valuable animals on earth, why do you think this is so?
5. What happened to the layers of soil in the worm hotel after five days?

X. Extended Activities
1. Measure the worms and make a graph of their lengths.
2. Do the "Math Worms" activity sheet.
3. After observing the worm hotel, students can make the kind of home they think their worm will like the most.
4. Find the food that the worms like best.

XI. Curriculum Coordinates
Literature:
Read *How to Eat Fried Worms* by Thomas Rockwell.

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Do earthworms have eyes?

Yes - No

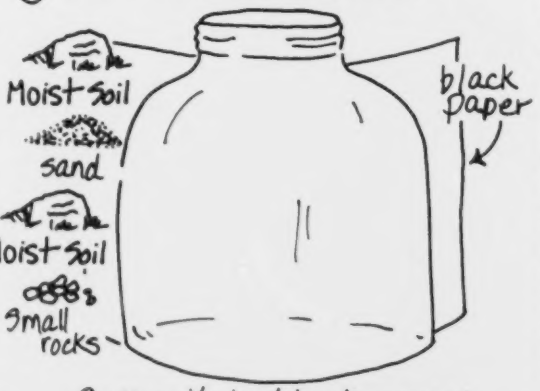
Do earthworms have ears?

Yes - No

Do earthworms have tiny hairs on their body?

Yes - No

Draw a picture showing how you layered your worm house.



Cover it in black paper.

Draw a picture of your worm house after 7 days.

The Earthworm

The earthworm's body is made up of many rings or segments.

The adult worm has a thick, whitish band around its body.

Draw your earthworm.

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NOW YOU SEE THEM, NOW YOU DON'T

I. Topic Area
Earthworms

II. Introductory Statement
Students will determine how long it takes earthworms to burrow into the ground.

III. Math Skills
a. Estimating
b. Measuring
c. Graphing
d. Problem solving

Science Processes
a. Observing
b. Collecting & organizing data
c. Generalizing
d. Hypothesizing

IV. Materials
earthworms
plastic cups of loosely packed soil
watch or clock with a second hand
activity sheets

V. Key Question
How long will it take a worm to burrow into the ground?

VI. Background Information
See worm fact sheets.

VII. Management Suggestions
1. This activity is best done in small groups.
2. Make sure you have enough worms. Each group needs three.
3. The soil used for this activity should be moist (but not too wet) and loosely packed.
4. The worms should be put in one at a time. The students can then make better informed estimates of the time it will take the second and third worms to dig into the soil.

VIII. Procedure
1. Pass out and discuss the activity sheet.
2. Divide the class into small groups and pass out a plastic cup to each group. The cup may already have the soil in it or it can be filled by the students.
3. Pass out three worms to each group.
4. Have students estimate the time they think the first worm will take to burrow into the soil and record their predictions on the activity sheet.
5. Place the first worm in the cup and time how long it takes to completely burrow into the soil. Record that time on the activity sheet.
6. Repeat the above process with the next two worms.
7. Discuss the results and complete the graph.
8. Discuss the question at the bottom of the page and have students explain how they could devise an experiment to find out.

IX. Discussion Questions
1. Did all the worms take the same amount of time to burrow into the soil? Why?
2. What would the effect of packing the soil more tightly have?
3. What would happen if you used different types of soil?

X. Extended Activities
1. Repeat the activity with three cups of the same soil, but varying compactness.
2. Repeat the activity with various types of soil such as moist sand, sandy loam, moist potting soil, etc.

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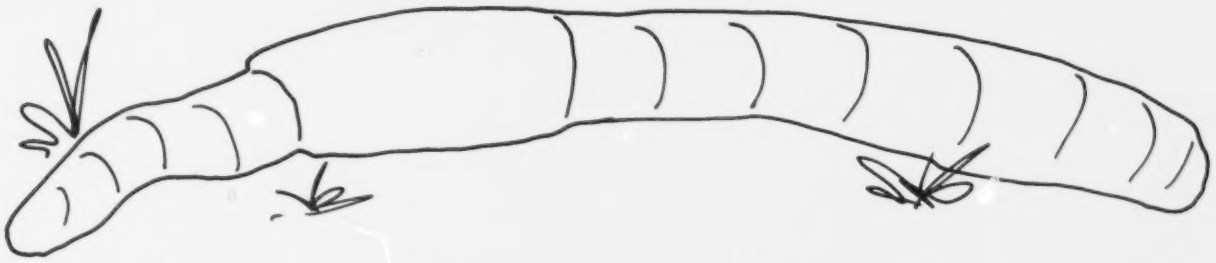
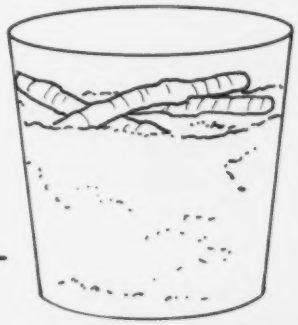
Now You See Them, Now You Don't.



How long will it take a worm to go underground?

Type of Soil: _____



	Guess:	Actual
Worm #1		
Worm #2		
Worm #3		

Do you think different types of soil will affect the time it takes to go underground?

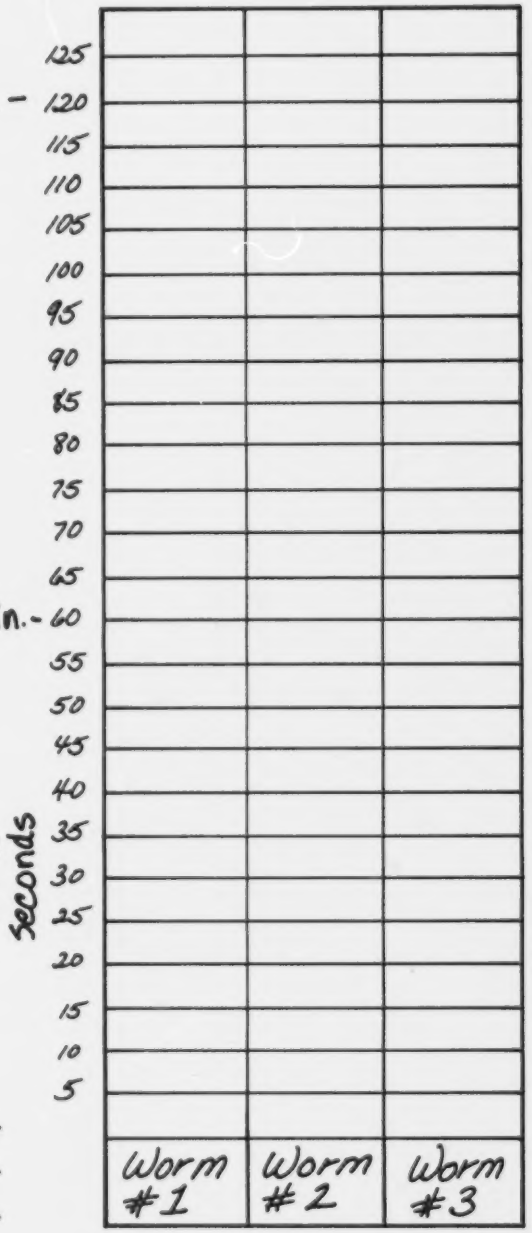
How could you find out?

_____

_____

_____

_____



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WIGGLE WORMS

I. Topic Area
Earthworms

II. Introductory Statement
Students will find out whether earthworms prefer an environment that is wet or dry, rough or smooth, dark or light.

III. Math Skills

Science Processes
a. Observing
b. Making and testing hypotheses
c. Drawing conclusions

IV. Materials
earthworms
wet and dry paper towels
sandpaper and notebook paper
flashlights and dark paper
activity sheets

V. Key Question
How can we find out what kind of an environment earthworms prefer?

VI. Background Information
The main sensing organ of worms is their skin. The worm does have a well developed nose and sense of smell, but no eyes or ears. A worm's skin is very sensitive and responds to moisture, temperature, touch and light. So, the worm actually uses its skin to see, hear, and detect moisture, as well as feel. The worm's skin must remain moist for it to breathe (it takes air out of the soil directly through its skin), so it will choose a moist environment over a dry one. Its skin is tender and so it prefers a smooth environment over a rough one. Its skin senses light and worms can tell when it is day or night. They are a nocturnal animal and rarely come out of the ground except at night, so they prefer a dark environment to a light one.

VII. Management Suggestions
1. Earthworms can be bought in bait stores or found by digging in moist earth. After a heavy rain they can be picked up off the sidewalks at school where they go to avoid drowning in the waterlogged soil.
2. Each child can have a worm or teams of two to four can observe one worm.
3. In preparation for this lesson, have students help gather the materials needed by bringing flashlights and sandpaper from home.
4. This is a good follow-up lesson for "The Earthworm".

VIII. Procedure
1. Discuss a way to determine scientifically, what kind of environment earthworms prefer.
2. Ask students to hypothesize as to whether worms prefer a wet or dry, smooth or rough, light or dark, environment.
3. Pass out the activity sheet and have students record their hypotheses. Make sure they explain why. For example, a good hypothesis (even though it is incorrect) would be: I believe that worms will prefer a dry environment because every time it rains worms come out of the ground and try to find a dry spot on the sidewalk.
4. Pass out worms and materials for the activity. Students can use the activity sheet to see how to set up each test.
5. Working individually, or in small groups, students can test each of their hypotheses and record their conclusions on the activity sheet.

IX. Discussion Questions
1. How can you tell what kind of an environment earthworms like?
2. Which did your earthworm prefer, the wet or dry paper towel? Why do you think this happened?
3. Does your earthworm like rough or smooth surfaces? Why do you think this is so?
4. Does your worm like light or dark areas better? How can you tell?
5. What other tests could be done to determine worm preferences?

X. Extended Activities
1. Brainstorm other earthworm preferences and ways to test them.
2. Make up your own question about an earthworm preference. Make an hypothesis, devise a way to test it and draw conclusions.
3. Worms are sensitive to all visible light except red. You can test a worm's reaction to different colors of light by darkening a room and shining a flashlight through different colors of cellophane. It should shy away from all colors but red. Fishermen are aware of this fact and collect nightcrawlers at night with a red light.

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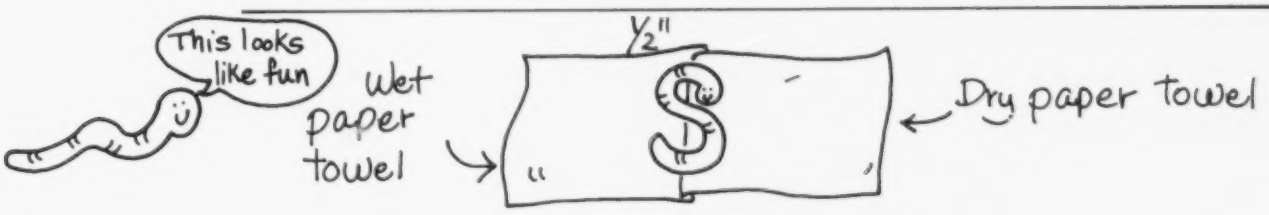
Name _____

Wiggle Worms

Question #1: Which environment do worms prefer? Wet or Dry

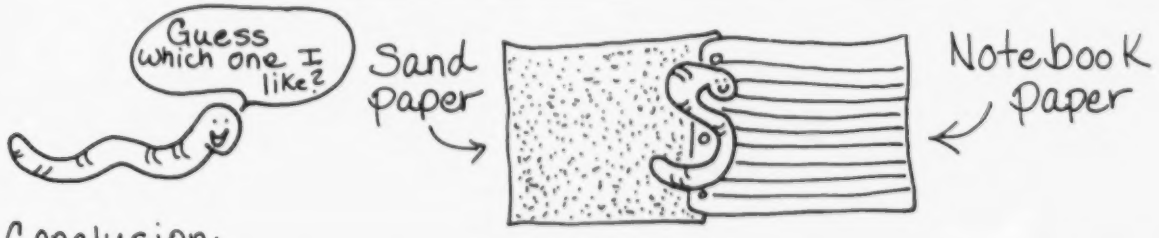
Hypothesis: (Tell Why) _____



Conclusion: _____

Question #2: Which surface texture do worms prefer? Rough or Smooth

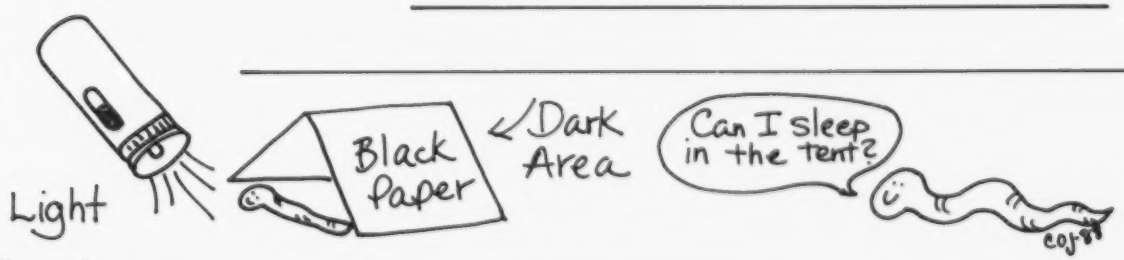
Hypothesis: (Tell Why) _____



Conclusion: _____

Question #3: Which lighting condition do worms prefer? Light or Dark

_____



Conclusion: _____

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YUMMY GUMMY WORMS

I. Topic Area
Observation

II. Introductory Statement
Students will make qualitative and quantitative observations of gummy worms using their five senses and simple measurement tools.

III. Math Skills
a. Measurement
b. Counting

Science Processes
a. Observing
b. Collecting & organizing data

IV. Materials
gummy worms
tape measures or rulers
balances and masses
magnifying glasses
paper bag for holding gummy worms

V. Key Question
How do scientists learn about animals in the wild?

VIII. Procedure
1. Ask the key question.
2. Discuss how scientists observe things in nature using their five senses and quantify their observations through measurement.
3. Teacher may want to use the element of surprise. Tell students they will be observing worms using all of their senses, including the sense of taste. The book *How To Eat Fried Worms* by Thomas Rockwell tells how a boy named Billy ate real worms and may provide a good anticipatory set for this activity.
4. Hold up brown bag and announce that the worms are in the bag.
5. Pass out a gummy worm (to the students' relief) and activity sheet to each child.
6. Allow students time to observe and measure their worms and record their observations (with pictures, words or phrases) in the appropriate sections. Note: Discuss why tasting should be done last.
7. Share observations and make comparisons between worms.
8. Students may want to also find the stretched length of their worm and count the number of segments.

IX. Discussion Questions
1. How were the worms alike?
2. How were the worms different?
3. How do gummy worms compare to real worms?

X. Extended Activities
1. Make a graph of worm lengths.
2. Observe real worms — use the same activity sheet.
3. Compare worms and mealworms.
4. Do the "Math Worms" activity sheet.
5. Older students can do the two activity sheets following "Math Worms" that involve stretching and measuring the gummy worms.

XI. Curriculum Coordinates

Literature:
Read *How to Eat Fried Worms* by Thomas Rockwell.

Language:
Write a story about "The Day the Worms Came to School".

Music:
Sing "The Worms Go Slithering One by One. . ."

Math:
See "Math Worms" activity page. Create story problems about gummy worms.

Oral Language:
Recite the poem on the activity sheet.

Creative Writing:
Cut out paper in shape of worms. Have students write their own poems on the worm shaped paper.

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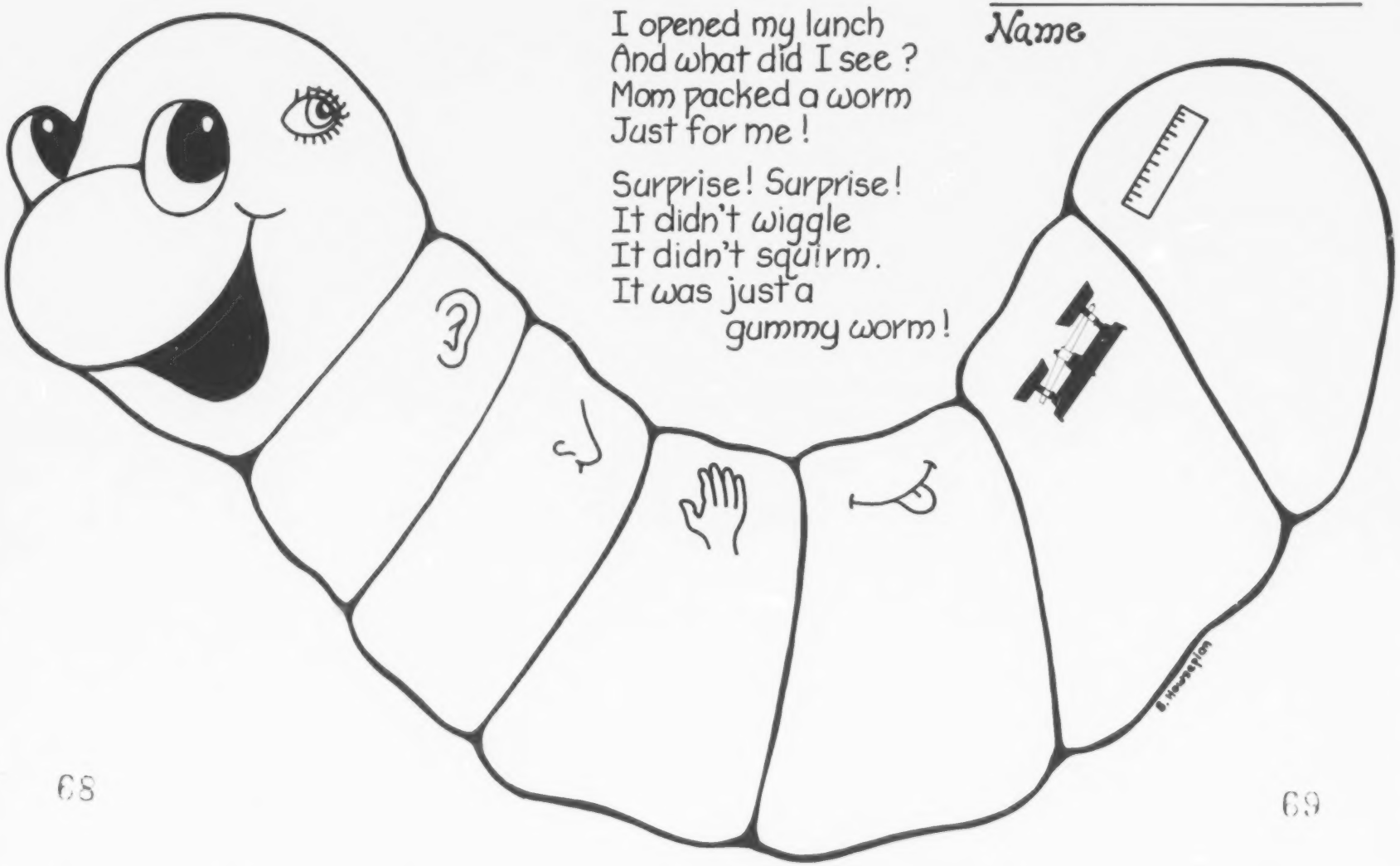
YUMMY GUMMY WORMS



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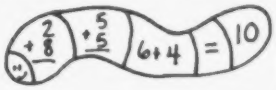
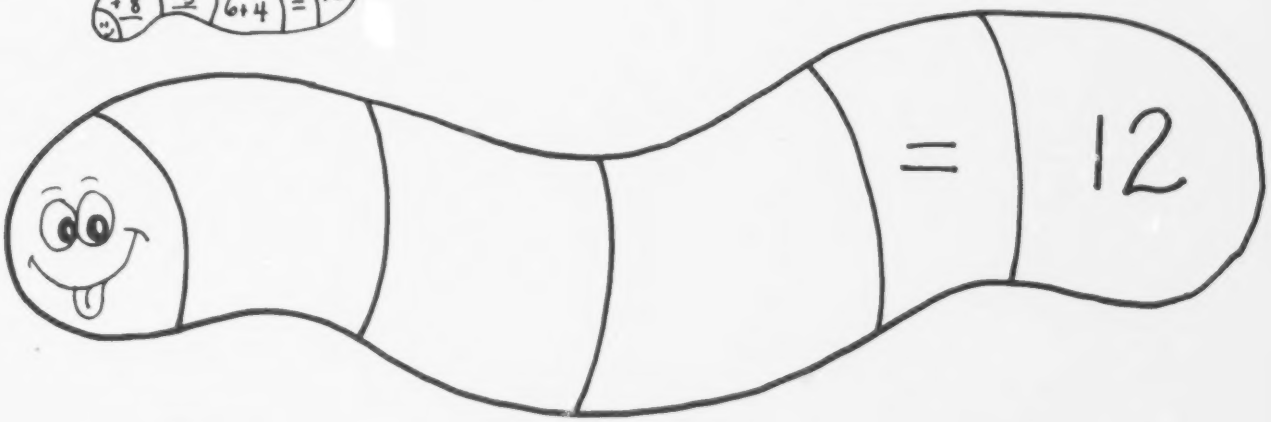
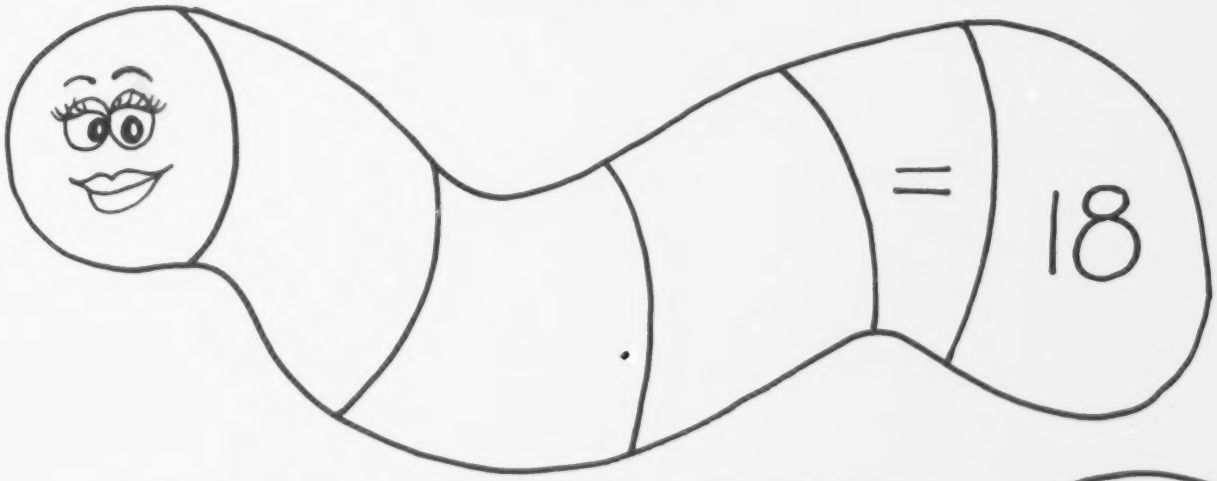
Name_____

MATH WORMS

Fill in each segment of the worm with a math problem that equals the number in the worm's tail.







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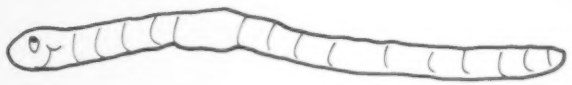
• Measure your gummy worm.

_____ cm



• Double the length of your gummy worm.

_____ cm

+ _____ cm

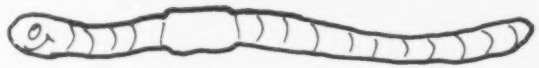
_____

_____ cm

71

STRETCH the worm to double the length

_____ cm



• Let go of it...
Measure again

_____ cm

• Did it stay stretched?
How much?

_____ cm starting length

− _____ cm length now

_____ cm difference

72

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- Measure your gummy worm

_____ cm

- Stretch your gummy worm as LONG as you can.

- Measure your STRETCHED gummy worm

_____ cm

- Find the difference.

The stretched gummy is _____ cm longer than it started.

- Cut your gummy worm in half.

- How long is each half?

½ a worm = _____ cm

- Do both halves equal the whole gummy worm? _____ yes/no

- Cut your worm into fourths.

- How LONG is a fourth?

¼ of a worm =

_____ cm

Snails

Snails are animals that are classified as invertebrates (no backbone). They have a soft body that is covered by a coiled shell. A snail's body has a head with eyes, tentacles, a mouth and tiny teeth. The snail creeps along using a strong muscular organ called a foot. It has tiny glands that make a layer of shiny slime. A snail protects its foot by sliding across the layer of slime.

Snails like to live in a moist environment. When it is too hot and dry a snail will curl up inside its shell and seal its opening with a layer of slime (mucus). Some snails can remain in their shells for two years waiting for the environment to become moist again.

Snails eat plants and rotting vegetation. They have tiny teeth which are attached to their tongues. They use this saw-like tongue to shred their food into small pieces. Snails usually feed in the late evening and at night.

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Snails
There are 80,000 kinds of snails
Snails range in size from 2mm to 61cm.
Snails live from 2-20 years.
Most snails have lungs.
The Helix Garden Snail is cooked and eaten as a delicacy called escargot.
out to lunch
A land snail has both male and female reproductive organs.
Snails, like clams and squid are classified as mollusks (shelled animals).
Snails live in three ecosystems; land, fresh water and salt water.
zzz
Some predators of the snail are birds, toads, mice and snakes.
Snails have no sense of hearing.
A snail's toothlike tongue is called a radula.
Slugs are similar to snails but have no shell.

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MY SNAIL'S TALE

I. Topic Area
Snails

II. Introductory Statement
Students will make a snail book based on observation and experimentation.

III. Math Skills
a. Counting

Science Processes
a. Observing
b. Comparing

IV. Materials
activity sheets
snails
various snail food items

V. Key Question
What do you know about garden snails?

VI. Background Information
See fact sheets on snails.

VII. Management Suggestions
1. Snails can be gathered in most gardens. They come out at night and can be found around ground cover and in wet areas. They can be kept in a container in the classroom and fed lettuce.
2. Ideally you should have enough snails so that everyone has one. However, a snail may be shared by a small group if there aren't enough to go around.
3. The snail book can be made up ahead of time or the sheets can be completed first by the students and then made into a book. The three sheets are cut in half and stacked together, then stapled along the left edge to make the book.
4. Students may do the entire activity in one day or it may be spread out over several days.
5. Make sure students have enough time to observe their snails before they are asked to work on the book.

VIII. Procedure
1. Make a list on butcher paper titled "Everything We Know About Snails." Brainstorm together as a class and see how many things can be listed.
2. Either pass out the snail fact sheets or read them to students so items can be added to the above list.
3. Pass out the snails and allow students ample time to observe them.
4. Pass out the activity sheets or the pre-made book. Have students draw a picture of their snail in the first box.
5. Students can draw the outline (side view) of their snail in the gridded box. They can count the number of squares the outline of their snail covers and compare that with others in the class.
6. Students can color in the body parts they observe on their snail on the next page. The parts that their snail doesn't have may be left blank or crossed out.
7. To do the "My snail eats" page students need to gather food they think their snail might like, such as leaves, grass, lettuce, flowers, etc. They need to put this food around the perimeter of a small box and place the snail in the middle of the box and observe what happens. This part of the lesson may take some time and may have to be repeated. Students can record their results on the page using words or pictures.
8. The next page has a place for a snail sentence, story or poem to be written.
9. Discuss the last section "Snail Spots," and decide which pictures show places where garden snails would like to live. Those pictures can be colored in and the others can be left blank or crossed out.

IX. Discussion Questions
1. What facts can we add to our list about snails?
2. How are snails different from people?
3. What other animals carry their own home with them?

X. Extended Activities
1. Build a classroom "Snail Hotel" for the snails.
2. Try to find places around the school ground that might have snails.
3. Find a slug and compare it to your snail.
4. Repeat the food test using foods that people normally eat, like bread, candy, vegetables, cereal, lunch meat, fruit, etc. Determine what kinds of people-food your snail likes.

XI. Curriculum Coordinates
Art:
Make a snail using a section of egg carton for the shell, cardboard for the foot and pipe cleaners for the eye stalks.
Math:
Count how many snails the class collected.

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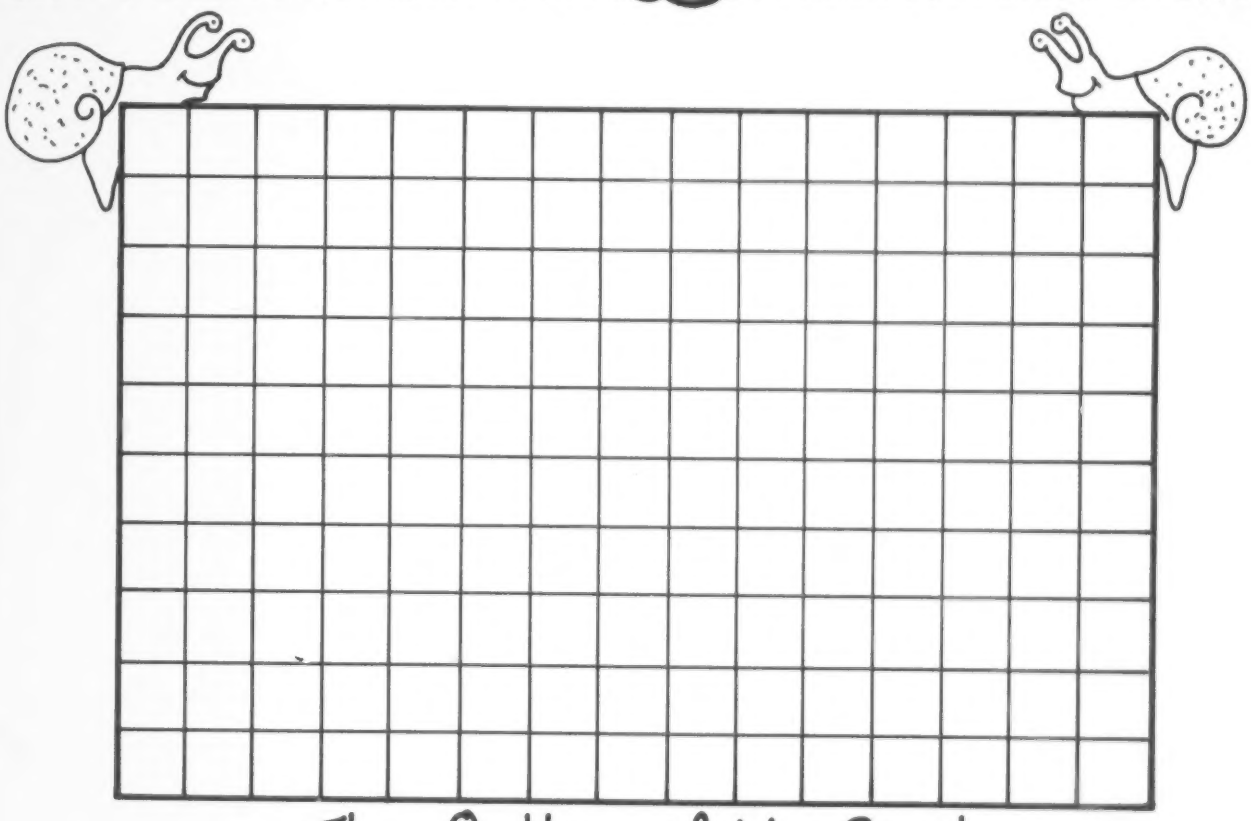
My Snail's Tale

By _____



The Outline of My Snail

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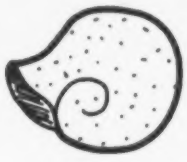
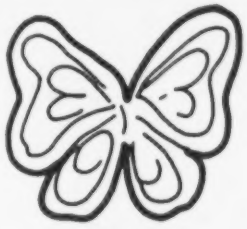
My snail has:



shell



wings

eye stalks

skates

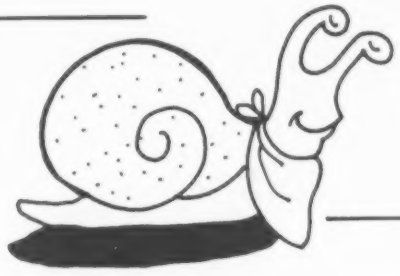
teeth

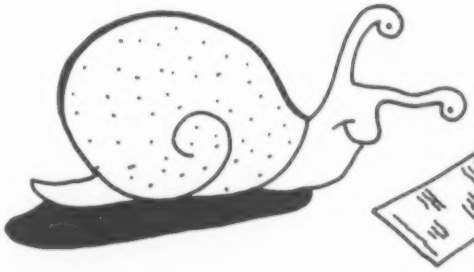
eyes

mouth

tail

My snail eats:





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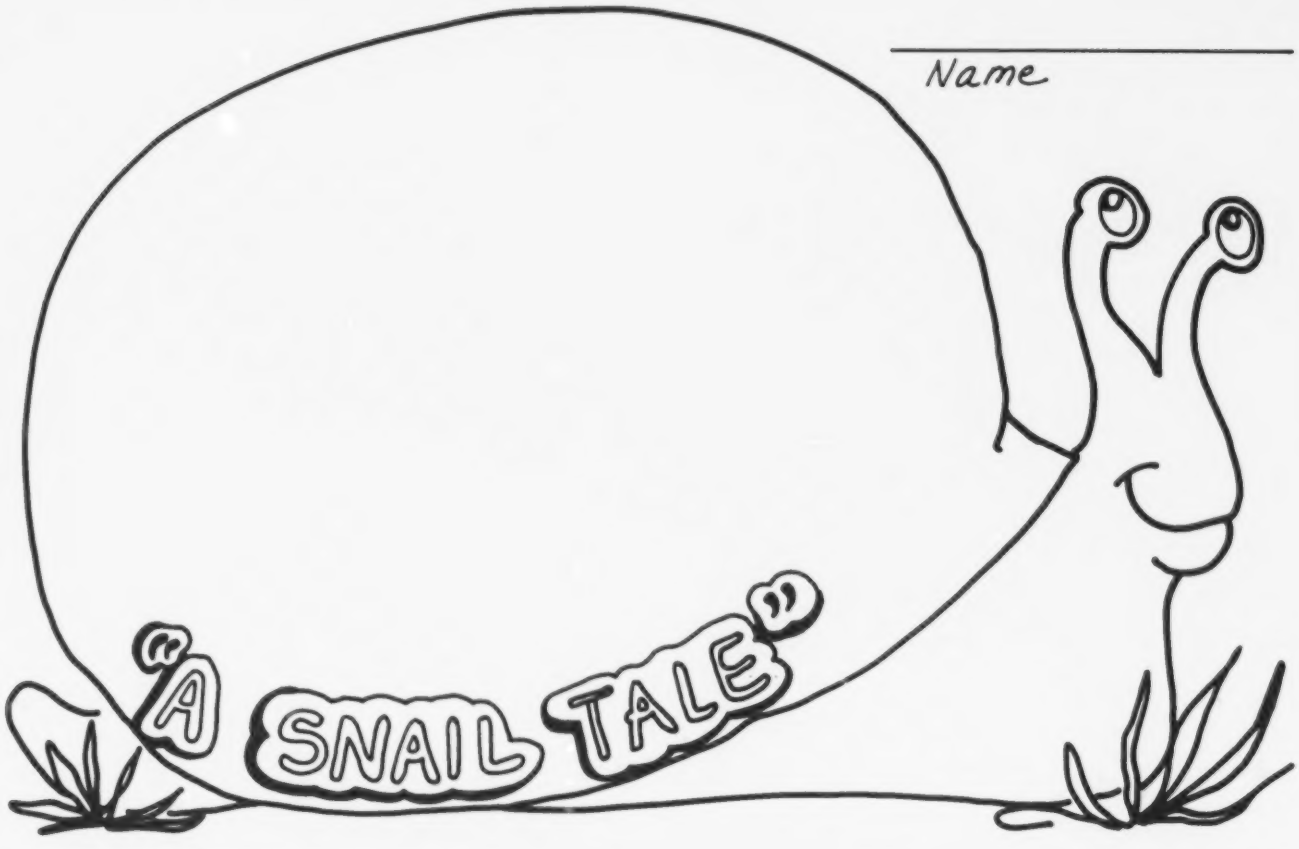
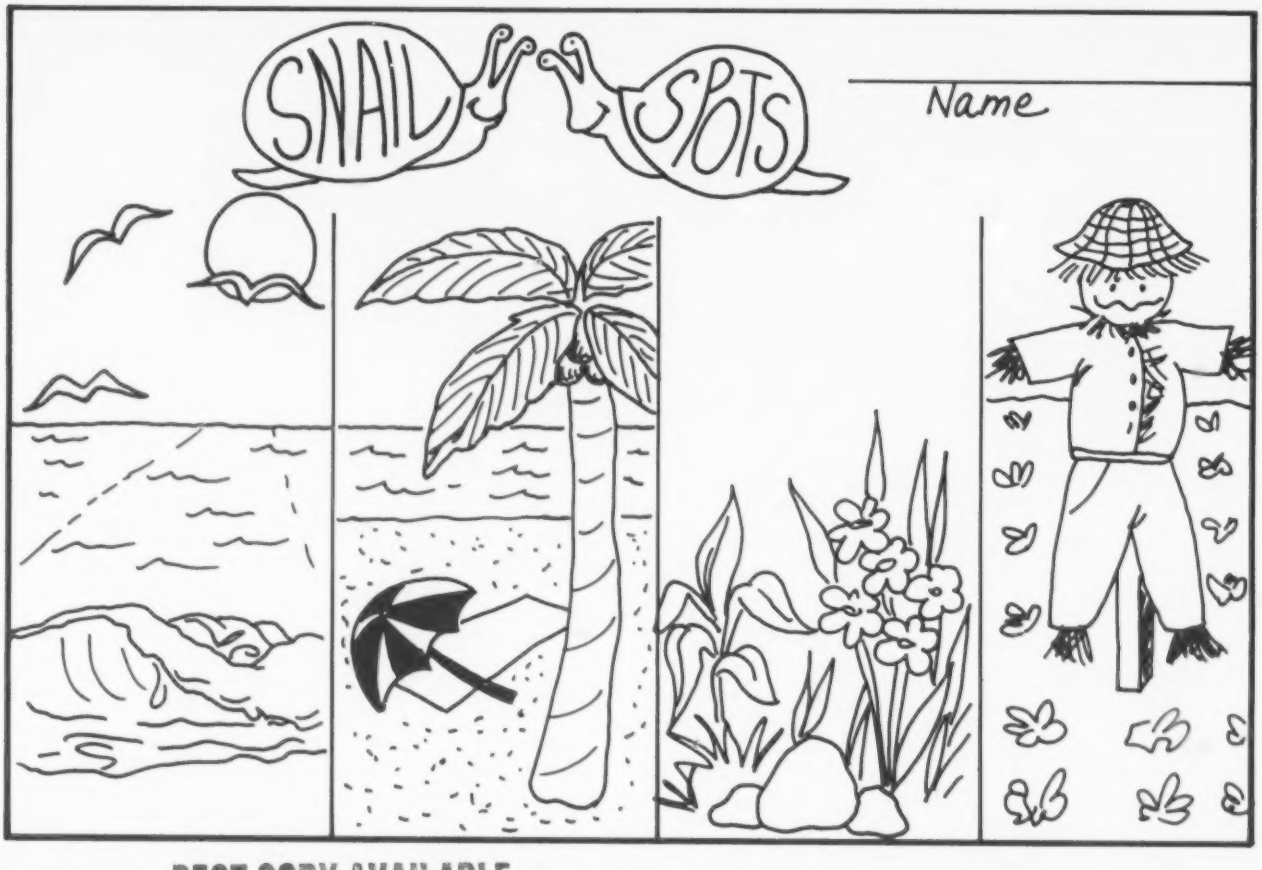
Name





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INSIDE OUT

I. Topic Area
Snail anatomy

II. Introductory Statement
Students will observe the various parts of a snail and measure its height, length and mass.

III. Math Skills
a. Measuring
b. Graphing

Science Processes
a. Observing
b. Collecting & recording data

IV. Materials
one snail and one 8 or 10 oz. clear plastic cup per student
scales and masses
rulers
scotch tape
activity sheets
scissors
crayons or markers

V. Key Question
What are the main body parts of a snail?

VI. Background Information
See snail fact sheets.

VII. Management Suggestions
1. Secure at least sixty snails for this lesson and the ones that follow. They are easy to find at night in most gardens near ground cover and wet areas. They can be kept in a covered container (with air holes) and fed lettuce.
2. The ruler on the activity sheet can be cut out and taped to the inside of a clear plastic 10 oz. cup so that it can be read from the outside. Snails will climb a cup (or any object) if it is placed in front of them. As the snail moves up the cup, he stretches out and is easily measured without any handling. Note: the cup should be taped to the desk to prevent it from tipping over as the snail climbs it.
3. Get as many scales as you can to speed up the massing process. Most garden snails will have a mass of approximately 5 to 10 grams. If gram masses are not available, paperclips, or other lightweight, uniform objects can be used.

VIII. Procedure
1. Tell the class that they will be observing the external parts of common garden snails.
2. Pass out the activity sheet, a snail and a clear plastic cup and ruler to each student.
3. Have students observe their snails and see if they can find the six parts listed on the sheet. Encourage them to share any other observations they make.
4. Discuss the measurement procedures for finding the length, height and mass of the snails. Have the students make these measurements and complete the activity sheet.
5. Have students share the lengths, heights and masses of their snails. This information can be recorded on the chalkboard or on a chart and graphed.
6. **Make sure children wash their hands after handling the snails.**
7. After the external features of the snails have been observed and the snails have been returned to their home, pass out the "Body of a Snail" activity sheet.
8. Fold the paper in half along the center line so that the top half (body parts list) folds behind the bottom half which shows the snail's internal organs.
9. Cut out the outline of the snail along the dotted lines making sure not to cut the sections so marked.
10. Open the paper back up and pick a color for each of the parts listed in the key. Color in the key and the corresponding body parts with the colors chosen.
11. Fold the paper so that the printed part is now on the inside. Have students draw the outside features of the snail on the outside of the paper producing a model of a snail that can be opened up to show the internal organs.

IX. Discussion Questions
1. Did the snails all look alike or were there individual differences that could be recognized?
2. How does the snail's anatomy compare to that of other animals or humans?
3. What things were you able to observe about your snail that you have never seen before?

X. Extended Activities
1. Try to find a way to distinguish individual snails.
2. Make a bar graph of the lengths, heights and masses of all the snails.

XI. Curriculum Coordinates
Language Arts:
Brainstorm adjectives describing the snails. Write snail poems.
Research:
Look up information on the various types of snails and their geographic locations.
Math:
Measure the circumference of the snail's shells. Compare the length of the foot to the total length.

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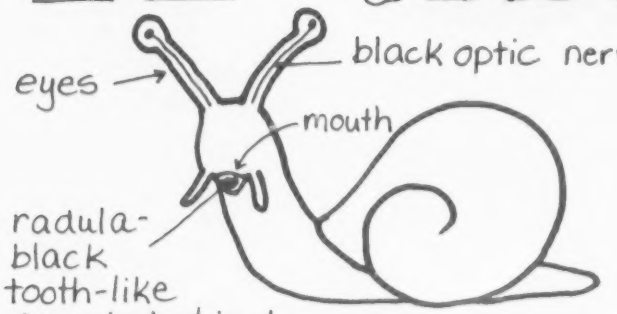
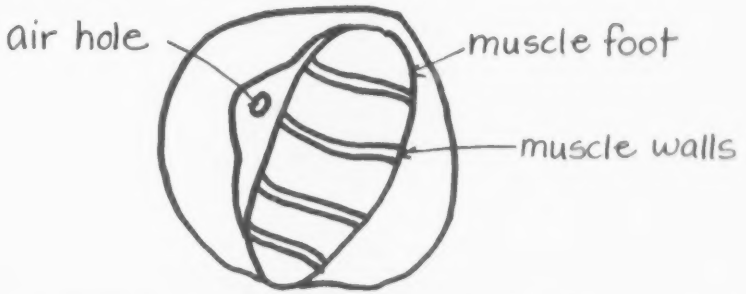
Inside Out

Name _____

side view

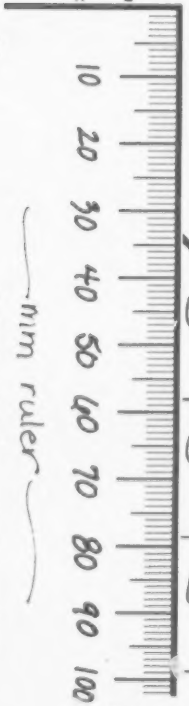


bottom view



Observe each of the following parts on your snail. Check off each part as you find it.

1. ____ eyes
2. ____ black optic nerve
3. ____ mouth
4. ____ black radula inside the mouth
5. ____ air hole
6. ____ muscle walls on the muscle foot



What is the length of your snail?

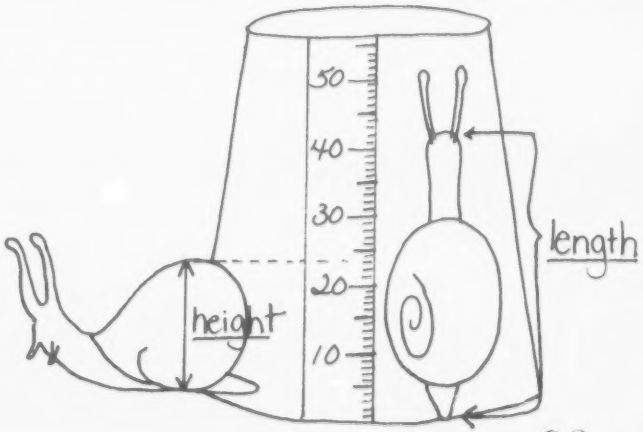
_____

What is the height of your snail?

_____

What is the mass of your snail?

_____



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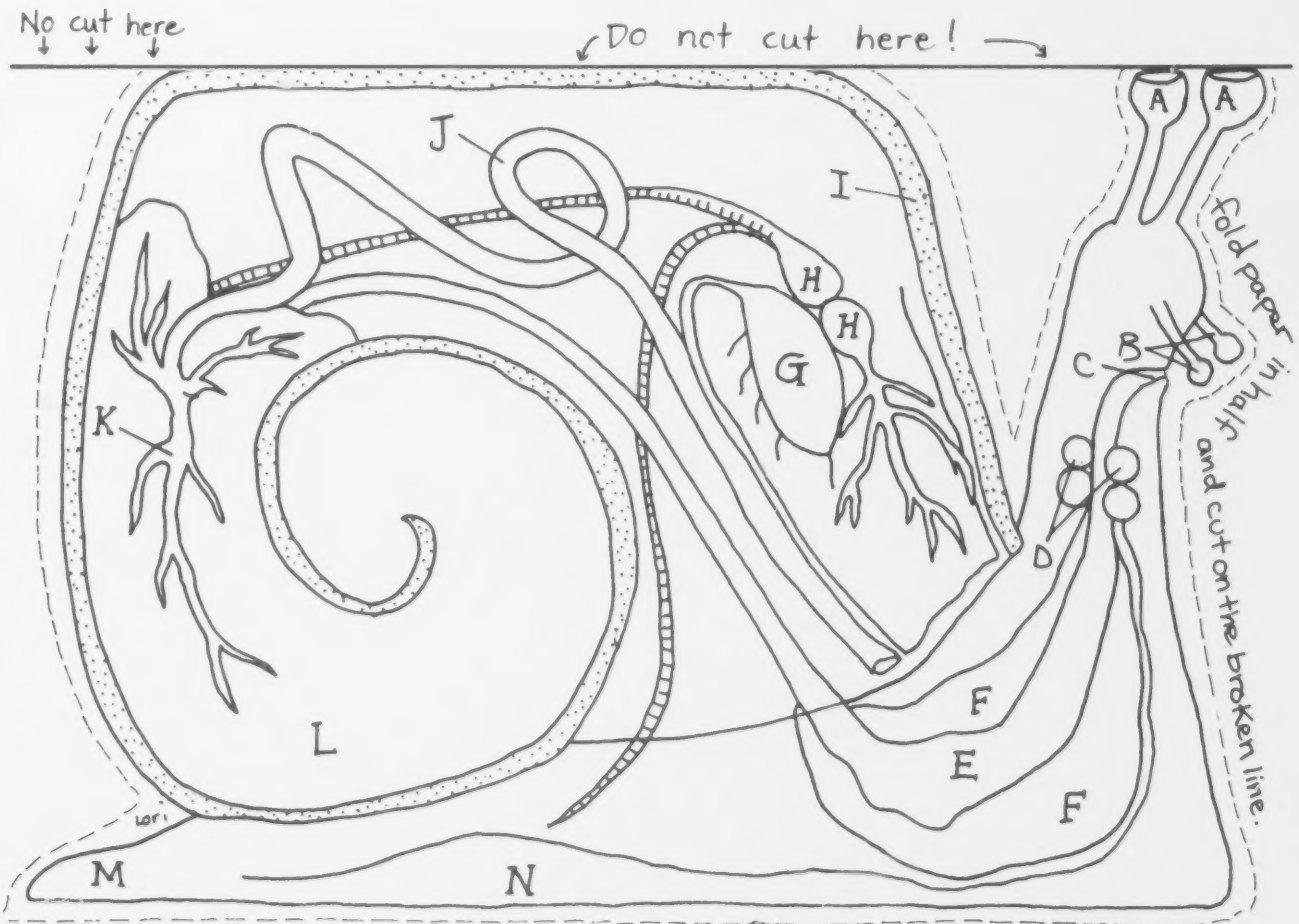
The Body of a Snail - Key

- ☐ A - Eyes
- ☐ B - Tentacles
- ☐ C - Mouth
- ☐ D - Nerve Centers
- ☐ E - Stomach
- ☐ F - Salivary Gland
- ☐ G - Kidney
- ☐ H - Heart
- ☐ I - Shell
- ☐ J - Intestine
- ☐ K - Ducts of Digestive Gland
- ☐ L - Digestive Gland
- ☐ M - Tail
- ☐ N - Foot



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PORTRAIT OF AN AVERAGE SNAIL

I. Topic Area
Snails

II. Introductory Statement
Students will make quantitative and comparative observations of garden snails.

III. Math Skills
a. Measuring
b. Averaging
c. Graphing

Science Processes
a. Observing
b. Collecting & organizing data
c. Classifying

IV. Materials
snails
clear plastic cups
activity sheets
water bottles
balance and masses
rulers
white-out or nail polish

V. Key Question
How would you describe the average garden snail?

VI. Background Information
See fact sheets on snails.

VII. Management Suggestions
1. Allow several days for students to collect and bring in snails so that there are enough for each student to have one.
2. Mark each snail with white-out or nail polish so that it can be identified. A dot of white-out with a student number written in pen on the dot works well.
3. Have a large box with a lid in the classroom for keeping the snails.
4. Review how to calculate averages and surface area, if necessary.
5. For the stretching out measurement, allow snails to climb a vertical surface.
6. Have students work in groups of four for this activity.
7. Snails like to climb. If the plastic cup is placed upside down in their path they will climb it, making it easy to measure them stretched out.
8. If you don't have rulers, the paper ruler on the activity sheet can be cut out and taped to the inside of the cup (with the zero mark at the lip of the cup) allowing students to measure both the height and the length of the snails.
9. If gram masses are not available the snails can be weighed using paper clips or other small uniform objects.
10. The total surface area of the snail will be hard to calculate. You may wish to have the students just trace the profile of the snail (side view) on the grid and find the surface area of the profile instead.

VIII. Procedure
1. Tell the students that each group will find the average mass, surface area, length and height for their group of snails.
2. Pass out the first two activity sheets and discuss them.
3. Have each group do each of the four measurements and fill in the first two activity sheets. They will find an average length, height, mass and surface area for their snails.
4. When all the groups have finished finding their averages and recording that information, pass out the third activity sheet and complete it together as a total class activity.
5. Discuss the results.

IX. Discussion Questions
1. Discuss what students learned about the average snails measurements.
2. Discuss other quantitative information about snails that might be explored.
3. Discuss whether or not the class findings could be used to predict what garden snails are like in other locations.
4. Discuss the factors that might affect the snails measurements.
5. Discuss ways to get more accurate measurements.

X. Extended Activities
1. Take a larger sample of snails and compare results. Perhaps two classes can do the activity and share data.

XI. Curriculum Coordinates

Language:
Write a story about the life of an average snail.

Geography:
Research snails and find out where they live around the world. Make a map showing your findings.

Science:
Try to find a way to keep snails out of your garden without using pesticides.

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PORTRAIT OF AN AVERAGE SNAIL

Name _____

Station A

Stretching Out (length)

snail #	prediction	length
	cm	cm
	cm	cm
	cm	cm
	cm	cm

_____ cm ÷ 4 = _____ cm
total lengths average

Station B

Standing Tall (height)

snail #	prediction	height
	cm	cm
	cm	cm
	cm	cm
	cm	cm

centimeter tape

_____ cm ÷ 4 = _____ cm
total heights average

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PORTRAIT OF AN AVERAGE SNAIL

Station C

Weighing in (mass)

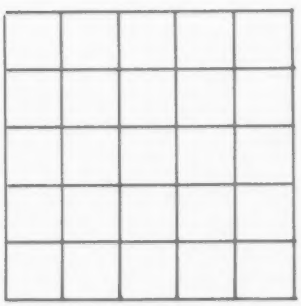
snail #	prediction	mass
	g	g
	g	g
	g	g
	g	g

_____ total grams g ÷ 4 = _____ average g

Station D

Squaring Off

snail#	prediction	surface area
	cm^2	cm^2
	cm^2	cm^2
	cm^2	cm^2
	cm^2	cm^2



cm grid

_____ total surface areas cm^2 ÷ 4 = _____ average cm^2

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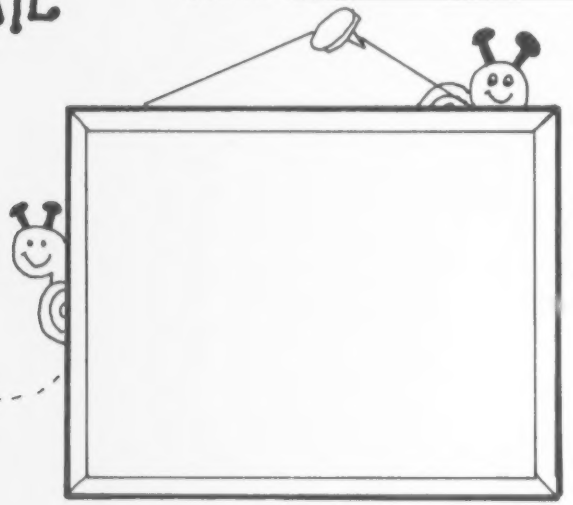
PORTRAIT OF AN AVERAGE SNAIL

Name _____



#1 My Group's Average Measurements:

_____ length
_____ height
_____ mass
_____ surface area

Let's Compare Averages:

Group	Mass	Surface Area	Length	Height
A				
B				
C				
D				
E				
F				
G				
H				
Class Total				
Class Average				

#2

Draw a scale drawing of your snail using the length and height measurements.

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THE SLIME TRAIL

I. Topic Area

Snail's rate of travel

II. Introductory Statement

Students will determine whether the big snails or small snails travel faster.

III. Math Skills

a. Measuring
b. Multiplying
c. Graphing
d. Problem solving

Science Processes

a. Observing
b. Collecting & organizing data
c. Predicting

IV. Materials

large and small snails
activity sheets
string
meter sticks or meter tapes (upper grades)
large sheets of dark construction or butcher paper
scissors and tape
watch with second hand

V. Key Question

Will a big or small snail travel farther in an hour?

VI. Background Information

Snails move very slowly. The common garden snail travels an average of three meters per hour. The snail has tiny glands in its flat muscular foot that secrete a layer of shiny slime. This layer of slime is put down as a road for the snail to travel on and allows the snail to travel over loose or day surfaces that would otherwise stick to its moist foot. If you watch a snail move, you can see the muscles in its foot move like waves.

VII. Management Suggestions

1. Make sure you have enough big and small snails so that each group has one of each.
2. This activity can be done in groups of 2-4 students.
3. This activity can be done at the primary level using the first activity sheet, which measures the distance snails travel in two minutes using pieces of string, or at the upper grade level using the second activity sheet which has students doing three trials and finding the average distance traveled in one minute time periods.
4. The activity sheets "A Trip to Snail World" and "The Up or Down Snail" are included in this lesson as extension activities for older students.

VIII. Procedure

1. Pass out the activity sheet and have students predict which snail will travel farther in two minutes (primary) or one minute (upper), a big or small one.
2. Pass out a big and small snail, two pieces of string and a large, dark piece of paper to each group.
3. Students will put the big snail on the paper and draw a line behind the snail. As soon as the snail starts moving begin timing a two (or one) minute interval.
4. When the time is up draw a second line behind the snail and then remove it from the paper. Lay one of the pieces of string along the path that the snail took (which will be visible because of the slime trail left on the paper) from the first line to the second line. This string can be cut to the correct length (primary activity) or marked and placed along a meter stick or tape to get the distance traveled in centimeters (upper grade activity).
5. Turn the sheet of dark paper over and repeat the process with the small snail.
6. Primary students can then make a direct comparison of the two strings and answer the question of which snail traveled farther in two minutes. The groups should share results and the two strings from each group can be taped to a bulletin board graph showing the distances traveled by the big and small snails.
7. Upper grade students should repeat the above process two more times, finding the average distance each snail travels in two minutes by collecting the data from three trials for each snail.
8. Fill in the activity sheet and discuss the results.

IX. Discussion Questions

1. Discuss why snails leave a slime trail.
2. Discuss the results of the activity and whether any conclusions can be made.

X. Extended Activities

1. Primary students may want to repeat the activity and compare results with the first trial.
2. Older students can do the "A Trip to Snail World" activity sheet using the average speed determined for their snails.
3. The snails vertical and horizontal speeds can be determined using the format presented in the activity sheet "The Up or Down Snail."

XI. Curriculum Coordinates

Art:

Make a picture from the slime trails by painting over them.

Science:

Research the snail and find out what the slime trail is and why the snail leaves it behind when he moves.

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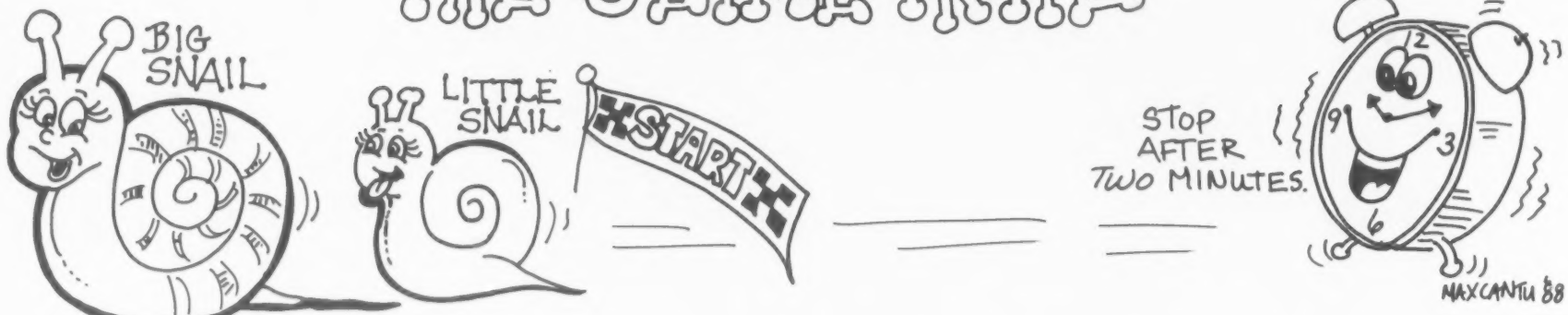
Name _____

THE SLIME TRAIL



I Think the _____ snail will travel farther in two minutes because _____.

Which snail actually traveled farther? _____.

Tell the slime trail story:

_____

_____

_____

_____

_____

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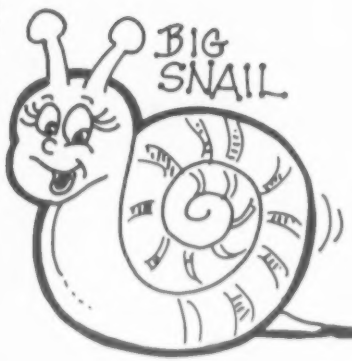
THE SLIME TRAIL

Name _____



	DISTANCE PREDICTION	TEST 1:	TEST 2:	TEST 3:	AVERAGE
BIG SNAIL	____ cm	____ cm/min	____ cm/min	____ cm/min	____ cm/min
LITTLE SNAIL	____ cm	____ cm/min	____ cm/min	____ cm/min	____ cm/min

BIG SNAIL'S RATE	AVERAGE CM ____ X 60 = ____ cm per hour ÷ 100 = _____ meters per hour
LITTLE SNAIL'S RATE	AVERAGE CM ____ X 60 = ____ cm per hour ÷ 100 = _____ meters per hour

1. HOW LONG WOULD IT TAKE THE BIG SNAIL TO TRAVEL 10 METERS?

FORMULA: DISTANCE ÷ RATE = TIME 10 meters ÷ _____ meters per hour = _____ hours.

2. HOW LONG WOULD IT TAKE THE LITTLE SNAIL TO TRAVEL 20 METERS?

FORMULA: DISTANCE ÷ RATE = TIME 20 meters ÷ _____ meters per hour = _____ hours.

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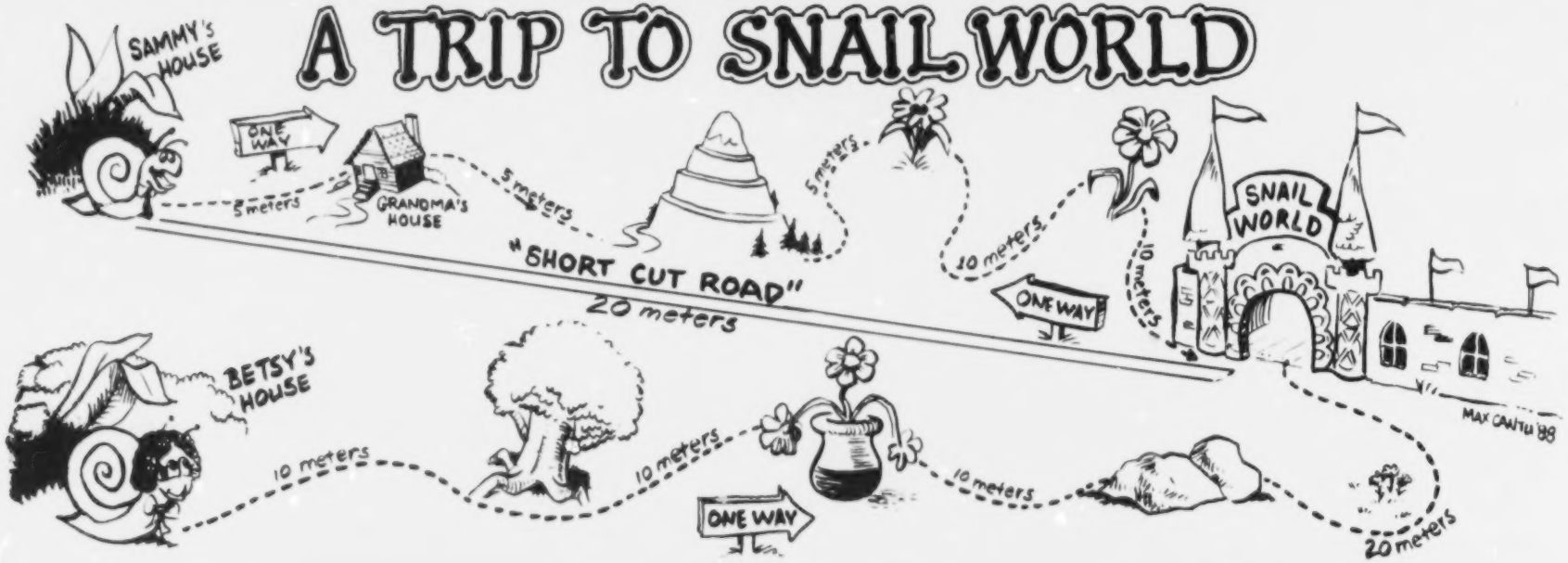
A TRIP TO SNAIL WORLD



BIG SNAIL AVERAGE METERS PER HOUR _____ MPH

SAMMY'S AVERAGE METERS PER HOUR _____ MPH

1. How long will it take for each of the snails to get to SNAIL WORLD ?

BETSY BIG SNAIL _____ SAMMY SMALL SNAIL _____

2. WHO will arrive first ? _____

3. At the end of the day, both snails were very tired so they took the "SHORT CUT" road home to SAMMY'S house.

- How long did it take SAMMY to reach his home? _____
- How long did it take BETSY to reach SAMMY'S house? _____
- What is the difference? _____

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THE UP OR DOWN SNAIL

I. Topic Area
Snails

II. Introductory Statement
Students will determine the rates that snails travel on horizontal and vertical surfaces.

III. Math Skills
a. Measuring
b. Computation
c. Averaging
d. Graphing
e. Rates

Science Processes
a. Observing
b. Collecting & organizing data
c. Predicting
d. Controlling variables
e. Generalizing

IV. Materials
snails
activity sheets
pieces of cardboard (8"×12" or bigger)
watch or clock with second hand
string and centimeter rulers or tapes

V. Key Question
Does a snail go faster on a flat surface or a vertical one?

VI. Background Information
See snail fact sheets.

VII. Management Suggestions
1. Make sure you have enough snails for each group or student to have one. You might need a few extra snails in case some of them are sluggish.
2. To get snails moving you can put them in a box or bag and place the bag on an overhead projector. Turn on the projector for a few minutes and the warmth from the lamp will get the cold-blooded snails moving, but will not harm them.
3. Dampening the table and ramp will also encourage the snails to move.
4. This activity works well with students in groups of 2–4.
5. Each group will need a cardboard ramp for their snail.

VIII. Procedure
1. Introduce the activity by asking students whether it is easier for them to walk on level ground or to climb up stairs or a hill? Ask them to predict whether a snail would go faster on a level surface or a vertical one.
2. Review the formula for finding rate:
   Rate = Distance / Time.
3. Pass out the activity sheet and discuss it with the students.
4. Divide the students into groups and give each group a snail and a ramp.
5. Have the groups use the classroom clock or a watch with a second hand to time the snail for one minute on a flat surface. The timing should begin as soon as the snail starts moving.
6. At the end of one minute, the distance the snail moved should be measured in centimeters and recorded on the activity sheet.
7. This process should be repeated two more times and the average rate the snail travels on horizontal surfaces can be calculated in centimeters/minute.
8. Set up the cardboard so that it is vertical and place the snail at its base. As soon as the snail begins climbing, time it for one minute. At the end of one minute find the distance traveled and record it on the activity sheet. Repeat this procedure two more times to find the average rate that the snail travels on a vertical surface.
9. Fill in the rest of the activity sheet and share group results with the class.

IX. Discussion Questions
1. Discuss why it is harder for people to climb hills than it is to walk on level surfaces.
2. Discuss why some animals, like snails, are able to climb vertical surfaces.
3. Discuss the findings of the groups. Draw conclusions.
4. Discuss other variables, such as the surface that the snail climbs, that might affect the results.

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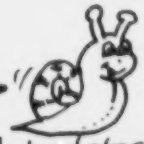
THE UP OR DOWN SNAIL

SNAIL OBSERVER: _____

QUESTION CAN A SNAIL TRAVEL AT A FASTER RATE ON A FLAT OR VERTICAL SURFACE?

PREDICT _____

$$\text{RATE} = \frac{\text{DISTANCE THE SNAIL TRAVELS}}{\text{TIME}} \qquad R = \frac{D}{T}$$

FLAT SURFACE 

VERTICAL SURFACE

*USE a string to measure the slime trail to determine the distance the snail travels in one minute.

TRIAL:	DISTANCE	÷	TIME	=	RATE
#1		÷	1 min.	=	cm/min
#2		÷	1 min.	=	cm/min
#3		÷	1 min.	=	cm/min
				TOTAL RATE	

TRIAL	DISTANCE	÷	TIME	=	RATE
#1		÷	1 min.	=	cm/min
#2		÷	1 min.	=	cm/min.
#3		÷	1 min.	=	cm/min.
				TOTAL RATE	

TOTAL RATE ÷3 = AVERAGE RATE
_____ ÷3 = _____ cm/min.

TOTAL RATE ÷3 = AVERAGE RATE
_____ ÷3 = _____ cm/min.

*The flat surface average rate was _____ the average vertical rate.
(>, <, =)

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WHAT'S YOUR ANGLE?

I. Topic Area
Snails

II. Introductory Statement
Students will determine how the angle of a ramp affects the rate at which a snail pulls a load up the ramp.

III. Math Skills
a. Measuring
b. Computation
c. Averaging
d. Graphing
e. Rates

Science Processes
a. Observing
b. Collecting & organizing data
c. Predicting
d. Controlling variables
e. Generalizing

IV. Materials
snails
activity sheets
pieces of cardboard (8" x 12" or bigger)
watch or clock with second hand
string and centimeter rulers or tapes
thread, tape and paper clips
scale (optional)

V. Key Question
How does the angle affect the rate at which a snail pulls a load up a ramp?

VI. Background Information
See snail fact sheets.

VII. Management Suggestions
1. Make sure you have enough snails for each group or student to have one. You might need a few extra snails in case some of them are sluggish.
2. To get snails moving you can put them in a box or bag and place the bag on an overhead projector. Turn on the projector for a few minutes and the warmth from the lamp will get the cold-blooded snails moving, but will not harm them.
3. Dampening the ramp will also encourage the snails to move.
4. This activity works well with students in groups of 2-4.
5. Each group will need a cardboard ramp for their snail.

VIII. Procedure
1. Introduce the activity by asking students if they could pull their own weight along a flat surface, up a ramp or straight up the side of a building. Tell them that the activity they will be doing will show if snails can pull their weight on a flat surface, up a ramp and straight up a vertical surface. They will be finding the difference in the rate at which the snail is able to do these things.
2. Pass out the activity sheet and discuss it. Demonstrate how to construct ramps of 30, 60 and 90 degrees using the angle finder on the activity sheet.
3. Review the timing and measuring procedures and how to calculate the rate the snail travels in centimeters per minute.
4. Divide the class into groups and give each group a snail, a cardboard ramp, a piece of string and a ruler (or a tape measure), some thread, paper clips, and tape.
5. Have the groups weigh their snails using paper clips (if scales are not available, they can estimate the weight—about 6 to 10 paper clips).
6. Tie the paper clips to the thread and tape the other end to the snail's shell so that the paper clips are a few centimeters behind the snail.
7. Place the snail and its load on the flat piece of cardboard. Make a mark behind the snail. As soon as it starts moving, time it for one minute. At the end of one minute, make another mark behind the snail and measure the distance the snail moved. Use this information to find the rate the snail traveled on a flat surface and fill it in on the activity sheet.
8. Set up the cardboard to make a ramp with a 30 degree angle. Place the snail on the ramp and repeat the above procedures to find the rate and record it on the activity sheet.
9. Repeat the above process for ramps of 60 and 90 degrees. Using the information from your chart complete the line graph on the activity sheet. Share group results with the class and discuss.

IX. Discussion Questions
1. Discuss the similarities and differences in the group results. Why do you think this happened?
2. Talk about ways to control variables and get more consistent results.
3. Discuss the effect of the size of the snails on the results.
4. Talk about other creatures that are able to carry their own weight.
5. Discuss the relationship of these results to the invention of the inclined plane.

X. Extended Activities
1. Find the maximum number of paper clips a snail can pull on level surfaces, or up various ramps.
2. Find out how many times its own weight a snail can pull.
3. Test the effect of the load a snail pulls on its rate.
4. Try other ramp angles.

XI. Curriculum Coordinates

Art:
Put some snails in a pan with some colored water (colored with food coloring) that just covers the bottom of the pan. The food coloring will not hurt them. Then place the snails on a piece of white paper and they will leave colored trails. Put several snails with different colors on the paper for fantastic results.

Language Arts:
Students can compose snail poems and write them on the colored snail trails.

Geography:
Research the different places snails are found around the world. There are over 80,000 varieties found on earth.

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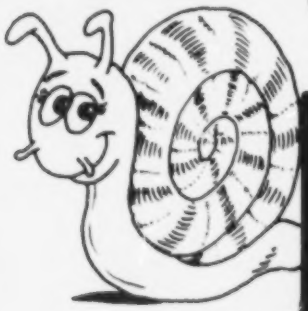
What's Your Angle?

Question: HOW DOES THE ANGLE OF THE RAMP AFFECT THE RATE AT WHICH A SNAIL PULLS A LOAD UP THE RAMP?

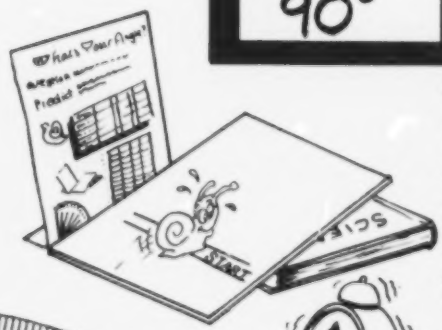
Predict: AT WHICH ANGLE DO YOU THINK THE SNAIL WILL TRAVEL THE FASTEST? _____

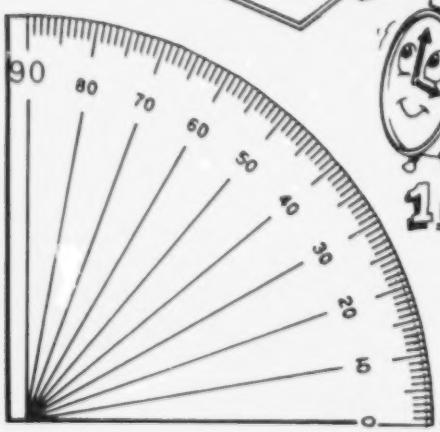
WHY? _____

_____

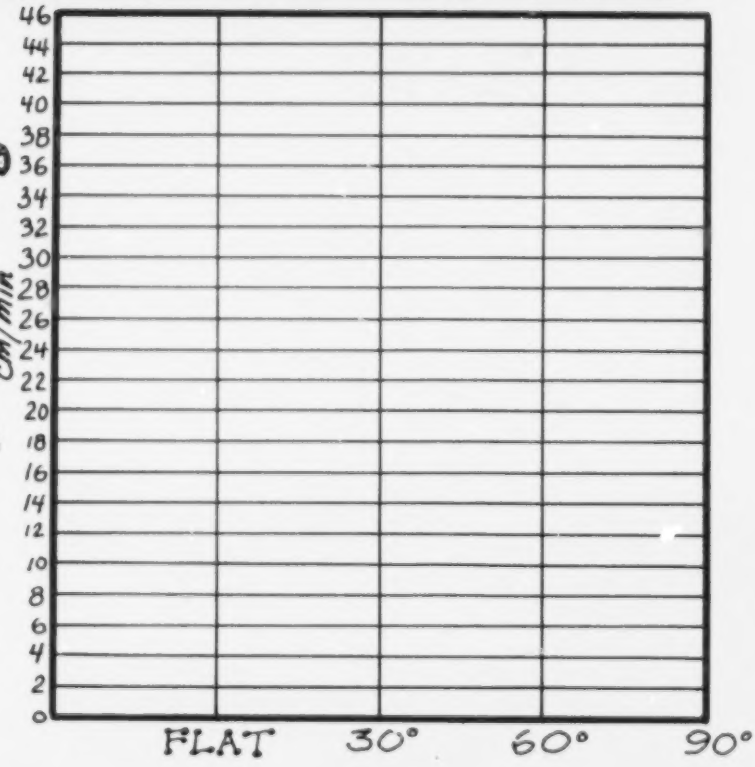


ANGLE:	DISTANCE	÷	TIME	=	RATE
FLAT (0°)	_____ cm.	÷	1 min.	=	_____ cm/min.
30°	_____ cm.	÷	1 min	=	_____ cm/min
60°	_____ cm.	÷	1 min	=	_____ cm/min.
90°	_____ cm.	÷	1 min	=	_____ cm/min.





cm/min



MAX CANTU '88

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SNAIL OLYMPICS

I. Topic Area
Snails

II. Introductory Statement
Students will have their snail compete in four Olympic style events.

III. Math Skills
a. Measuring
b. Counting
c. Computation

Science Processes
a. Observing
b. Collecting & organizing data

IV. Materials
snails
activity sheets
string
pencils
large plastic cups
tape
cardboard tube sections (about 1" long)
water bottle

V. Key Question
What does a snail do when it encounters obstacles in its path?

VI. Background Information
Snails will often climb over objects put in their path instead of going around them. They will also tend to climb up vertical and near vertical surfaces. Snails need a moist environment to survive and will tend to follow a damp trail on an otherwise dry surface. Since snails are cold-blooded, they will be more active when they are warm.

VII. Management Suggestions
1. Make sure you have enough snails so that each group or student has one.
2. This activity can be done individually or in groups of 2–4 students.
3. The events can be done individually or together in an Olympic format.
4. The snails can be made more active by squirting water on them and placing them in a warm (not hot) location.
5. To get the snails to follow a path, the dry surface can be moistened with a water bottle.

VIII. Procedure
1. Set up the events as shown on the activity sheet. The top of a table, or a tile floor are good places for the Olympics.
2. For the big race snails are placed on the starting line. They are allowed to travel in any direction. At the end of three minutes their position is marked and their slime trails can be measured using a piece of string or a tape measure. A sheet of dark paper placed on the table will highlight the slime trail and make measuring it easier.
3. To set up the hurdles, place pencils 5 centimeters apart on a flat surface. To get the snails to go in a somewhat straight line over the hurdles, a water bottle can be used to create a damp path which the snails will hopefully follow.
4. For the mountain climbing event place the snail near an inverted cup that is taped to the table or floor.
5. For the tunneling event, space the tubes about 5 centimeters apart. The tubes may have to be moved to get the snails to go through them. They may also want to climb the tube instead of go through it. This event is the most difficult one to get the snails to cooperate.
6. After the events are completed the points can be tabulated and the winning snail can be determined.
7. Complete the activity sheet and discuss the results.

IX. Discussion Questions
1. Discuss what the tendency of snails is when they meet obstacles. Do they prefer to go over, through, or around objects in their paths?
2. What event was your snail best at? Worst? Why do you think this happened?

X. Extended Activities
1. Try the Olympics again and see what you can do to help your snail get better scores.
2. Older students can do the "A Snail's Pace" activities using the activity sheet provided.

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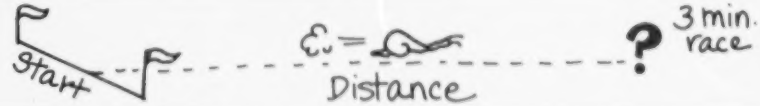
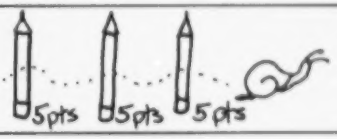
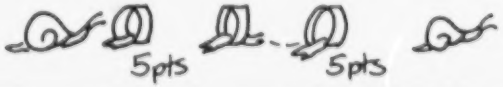
Name _____

Snail Olympics

Events:	How to:	Total:
1. Big Race:	 1 pt per cm	_____
2. Hurdles:	 Count the # of pencils the snail goes over in 3 min. 5 pts per pencil	_____
3. Mountain Climbing:	Less than 2 minutes = 20 pts More than 2 minutes = 10 pts	_____
4 Tunneling:	 5 pts per Tube	_____
1. What was your snail's best event? _____		Total Points: _____

2. Observations: What happened when the snail saw the pencil? _____

3. What happened when the snail saw the toilet paper tubes? _____

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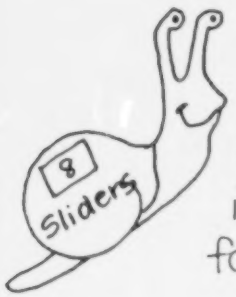
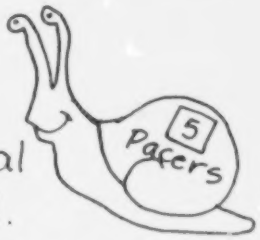
A Snail's Pace

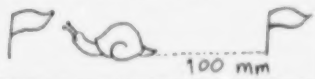
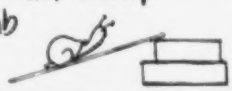
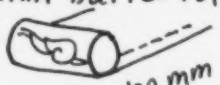
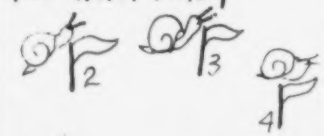
Name _____

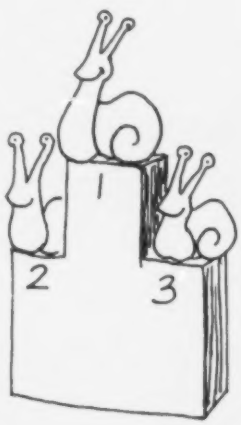




A snail track team is participating in a track meet in which a gold medal is awarded for first place, a silver medal for second, and a bronze medal for third.

You may enter two snails from your team in all except the relays. Enter a team of four snails in the relay and find their average rate. The rate is found by dividing the distance by the time in seconds.

Event	Team Member	Total Time	Rate mm/sec.	Rate cm/sec.
100 mm dash 				
100 mm low hurdles				
100 mm vertical climb				
100 mm ramp climb 				
100 mm barrel roll 				
400 mm relay 				
Team Total				
Team Average				



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SILKWORM FACTS

Silkworms are the larval stage of silkmoths.

Silkworms molt 4 times.

Eyes can only tell light and dark.

Silk can be stretched and is very strong.

A silkworm just before it becomes a pupae, is about 1000 times larger than when it became a silkworm.

A silkworm's spinneret is found under the mouth.

Each thread of silk is really two threads twisted and stuck together.

Silkworms like to eat in dark quiet places

Mosquitoes and ants are enemies of silkworms

Silkworms have 3 pairs of real legs and 4 pairs of false legs.

Adult silkmoths never eat.

Silkworms were first raised in China about 5000 years ago.

Male moths are longer and thinner than female moths.

Silkmoths cannot fly.

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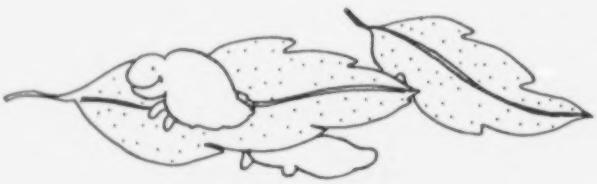
SILKWORMS

Beautiful silk fabrics come from small, off-white, colored silkmoths. These insects are raised commercially on Silkworm farms. Like many insects they have a 4 stage life cycle beginning as an egg. It is easy to watch the complete life cycle in the classroom as long as there is a Mulberry tree nearby.

Once new spring leaves appear on a Mulberry tree, the small eggs may be set on fresh leaves in an uncovered box. Within a week the eggs will begin to hatch into black silkworms about the size of a comma. Be sure the small silkworms have fresh Mulberry leaves every day, removing dried out leaves. They will grow quickly. Once the silkworms are large enough to see easily you can place a screen or netting with fresh leaves on top of the old ones.



The silkworms will crawl through to the new leaves and make it easy to dispose of the used ones. Silkworms will continue eating for 25-30 days, ultimately becoming 10,000 times bigger than when hatched. When the silkworm is ready to spin a cocoon it will stop eating and move its head back and forth repeatedly. You may want to provide small branches on which the cocoon can be spun.

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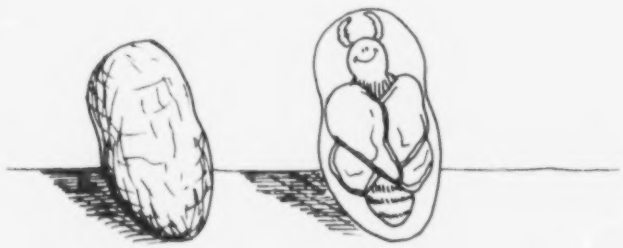
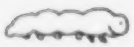
The silkworm will use the spinneret under its mouth to make a support strand of silk. Next, its body will become a U-shape and the silkworm will make figure 8 loops with its head. For 3-4 days this process continues until the cocoon is completed. Safe inside the cocoon, the silkworm molts, becoming a pupa for 10-14 days. While in the cocoon the final metamorphosis from pupa to moth gradually takes place.





Once the metamorphosis is complete, the moth makes a small hole in the cocoon and frees itself. The adult moths cannot fly and do not eat. Their only job is to reproduce themselves by mating and laying more eggs. They may live for up to a week. Females lay between 300-500 eggs in neat rows during this time. The eggs are yellow at first but quickly change to a gray color. These eggs can be saved for the following spring by refrigerating them in baggies or small containers. There will be plenty to share with a friend!

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GROWING PAINS

I. Topic Area
Silkworms

II. Introductory Statement
Students will determine if the amount of food a silkworm gets affects its growth rate.

III. Math Skills
a. Measuring
b. Graphing
c. Counting
d. Averaging

Science Processes
a. Observing
b. Collecting & recording data
c. Comparing
d. Predicting
e. Concluding

IV. Materials
1 silkworm and container per student
fresh mulberry leaves
magnifying glass
activity sheets
ruler that measures millimeters

V. Key Question
How will the number of leaves a silkworm eats affect how much it grows?

VI. Background Information
See silkworm fact sheets.

VII. Management Suggestions
1. Be sure there is a mulberry tree nearby or that you have access to a daily supply of fresh mulberry leaves!
2. This activity is more easily done if you begin about 10 days after silkworms emerge. They are very difficult to measure prior to this time.
3. Remind students to always handle the silkworms gently.
4. Plan to collect data for about two weeks.
5. Silkworm eggs may be ordered from Insect Lore Products, Inc., Box 1535, Shafter, CA 93263. The order phone number is (800) LIVE BUG. Eggs are available March through May only.

VIII. Procedure
DAY ONE
1. Distribute one silkworm in a small container and a hand lens to each student.
2. Allow time for observations and record on a class chart.
3. Have students complete the observation activity sheet and discuss.

DAY TWO THROUGH SIXTEEN
4. Discuss the key question.
5. Determine a way to find how the amount of food affects the growth of a silkworm.
6. Assign a special diet of either 1, 2, 3, 4, or 5 leaves per day to each student's silkworm. (Try to have equal numbers of silkworms for each diet.)
7. Pass out the first activity sheet and explain that each student will be responsible for feeding their silkworm the proper number of leaves and measuring its length each school day.
8. Once the first activity sheet is completed after 10 to 14 school days, all students whose silkworms had the same number of leaves each day share their data to find the average final length for that particular diet. This information should be filled in on the first activity sheet.
9. Pass out the second activity sheet for the class results and have each group share their data and fill-in the table and line graph.

IX. Discussion Questions
1. Did the silkworms that were fed the most grow the longest?
2. What did your line graph tell you about the affect of the amount of food eaten on the growth of silkworms?
3. Using your data, is it possible to predict the continued growth of a silkworm with a certain diet?

X. Extensions
1. Try to find a pattern of growth relative to the number of leaves given.
2. Find out if there are other Lepidopteras (moths or butterflies) that cannot fly.
3. Compare silkworms with mealworms and butterfly larvae.
4. Study the life cycle of the silkworm by continuing the observations begun in this activity. The life cycle can be drawn on the "Metamorphosis Wheel" found in the "My Mealworm" activity. A life cycle chart can also be made by students using a grain of rice to represent the egg, a short length of white pipe cleaner to represent the silkworm larva, a lump of cotton or an actual cocoon to represent the pupal stage and a cut out picture of a moth (from the "Missing Moths" activity) or drawing of the silkworm moth to represent the adult stage.
5. Make a silkworm book to chronicle the life of your silkworm.

XI. Curriculum Coordinates
Art:
Collect pieces of silk fabrics and make a display.
Research:
Look up rayon. Tell how it is made.
Science:
Make a list of other insects that have the same four stage life cycle.
Math:
Count the number of moths that laid eggs and multiply by 500 to figure out approximately how many eggs were produced for the next year.

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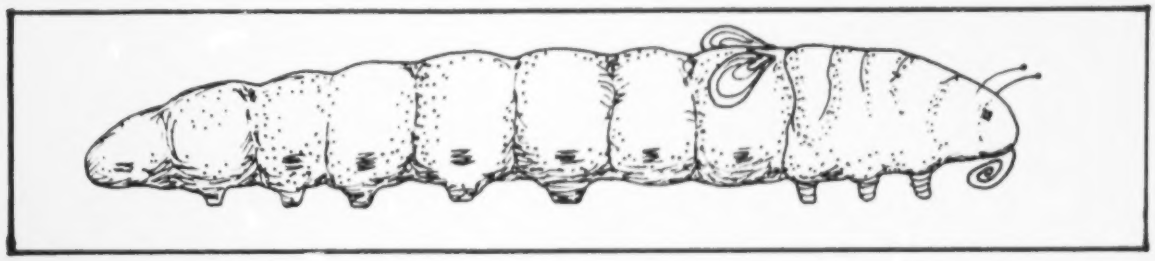
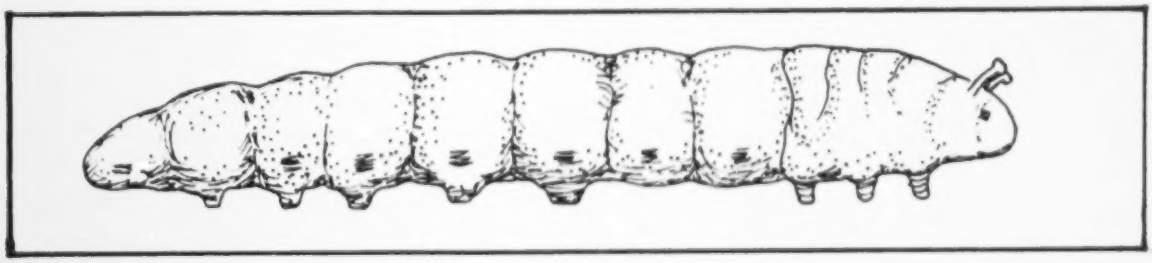
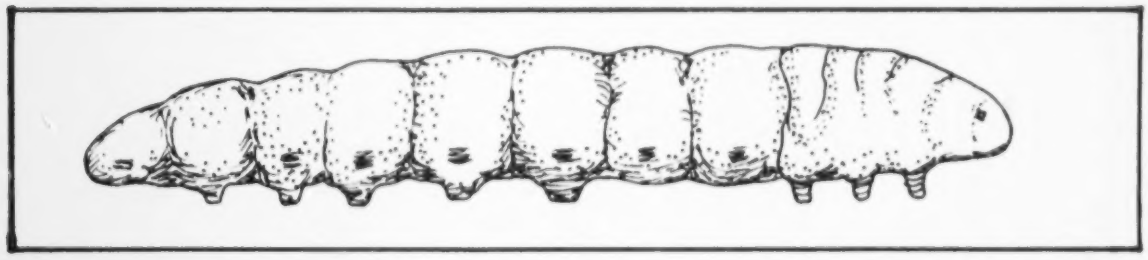
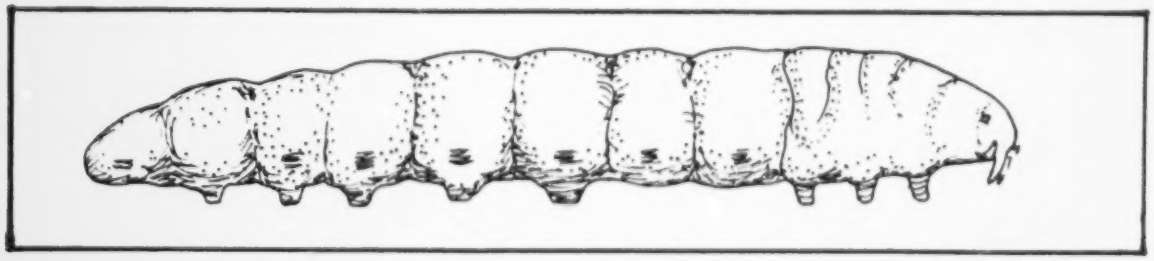
Silkworm Observation

Study your silkworm carefully. Color the picture that looks the most like a real silkworm.









Watch your silkworm eat. What do you observe?

_____

_____

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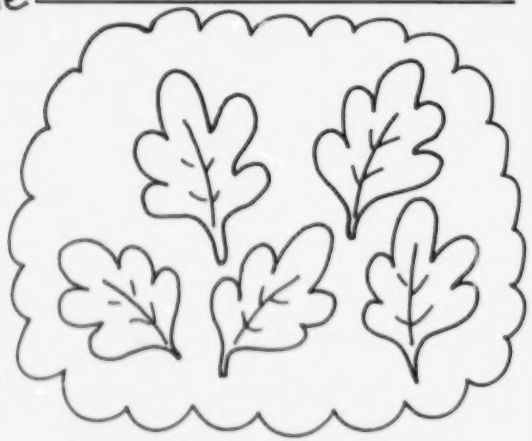
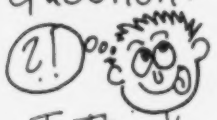
GROWING PAINS

Name _____



Question: Does the amount of food available affect the growth of a silkworm?



_____

Day	Length in mm
1	mm
2	mm
3	mm
4	mm
5	mm
6	mm
7	mm
8	mm
9	mm
10	mm
11	mm
12	mm
13	mm
14	mm

111

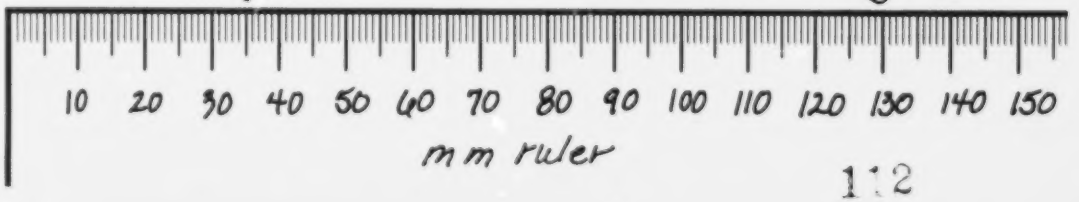
Average

Dietician	Final Length
1	mm
2	mm
3	mm
4	mm
5	mm
6	mm
7	+ mm

_____ ÷ _____ = _____

Total mm | # of dieticians | Average growth

Color in the # of leaves you will feed



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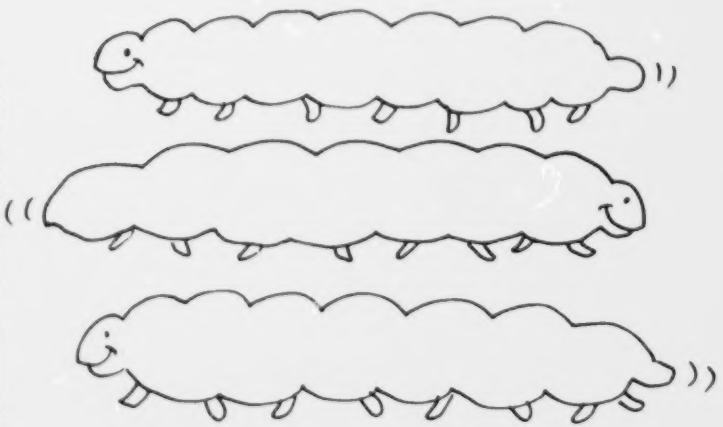
GROWING PAINS

NAME _____

Class Results

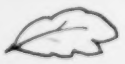
# of leaves	Group Average
1 leaf	mm
2 leaves	mm
3 leaves	mm
4 leaves	mm
5 leaves	mm



CLASS LINE GRAPH

mm of growth

# of leaves



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ISOPODS

Cut a 2"x 11" strip to cover the answers. Pull down as answers are needed.

- What family do isopods belong to?

Crustaceans. Isopods are invertebrates.

- How do isopods breathe?

Through their gills.

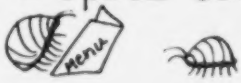
- How many pairs of legs does a newborn isopod have?

6 pairs

- How many pairs of legs does an adult isopod have?

7 pairs

- What do isopods eat?



Anything soft, moist. They are scavengers

- Name 2 other crustaceans.

crab, shrimp, lobster

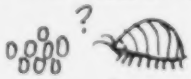
- Can isopods jump or climb?

No, they can only walk.

- When does an isopod shed its skin?

As it grows.

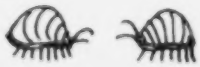
- Where does the female carry her eggs?



In a pouch on her underside.

- What do baby isopods look like?

They are smaller and lighter colored than adults.



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HOT FOOT, COLD FEET

I. Topic Area
Critters response to temperature

II. Introductory Statement
The students will set up an experiment in which they observe the temperature preference of isopods. This activity can also be used with other invertebrates.

III. Math Skills
a. Counting
b. Graphing
c. Predicting

Science Processes
a. Observing
b. Measuring
c. Predicting
d. Recording data
e. Controlling variables

IV. Materials
Per group of 4:
3 sandwich size ziplock baggies
1 sheet 12" x 24" aluminum foil
10 critters: sow bugs (isopods), earthworms (night crawlers), mealworms or snails
3 thermometers (optional)
hot water, cold water, room temperature water
plastic wrap

V. Key Question
What temperature will the critters prefer: hot, room temperature or cold?

VI. Background Information
Temperature is a very important aspect of an invertebrates environment. Invertebrate's do not have the ability to control their body temperature. As a result, their existence is dependent on the temperature of their surroundings. If the environment becomes too cool or too warm the animal cannot adjust to it and will die. Most invertebrates prefer a temperature range between 60° to 90° F. Isopods generally prefer a dark, moist and cool area (65°).

VII. Management Suggestions
1. Collect enough isopods beforehand so that each group has ten. Students love to help collect isopods and can usually find them in their yards.
2. This lesson has 2 different group tally sheets. Select the one that best addresses the ability level of your class.
3. You may have to cover the ramp with a box to get the isopods to settle in one spot. In a bright room they tend to be too active and don't settle down.

VIII. Procedure
1. Have students discuss what they already know about the critter being used. Record their responses on the board.
2. Have them tell how they have learned about their critter. Many may respond by saying they observed much of what they know about the animals. Stress the importance of observation.
3. Ask the key question.
4. Explain the set up for the experiment. Set up 3 lunch baggies—one filled with ice water, one with room temperature water and the 3rd with hot tap water for each group. Remove as much air as possible from each baggie.
   * Optional: Find the temperature of each of the baggies and record it on the activity sheet next to the baggies marked: hot, room temperature and cold.
5. Teacher:
   a. Demonstrates how to make or use the aluminum foil ramp.
   b. Demonstrate how to put critters into the center of the ramp and then cover ramp with plastic wrap. (there is enough air in the ramp for the critters when covered).
   c. Explain how to time and count the number of critters in each temperature zone and record it on the activity sheets — use the baggies as a reference point for each temperature zone.
6. Be sure to have the students predict the number of critters that will be in each area at the end of 10 minutes.
7. Pass out equipment, answer any questions and begin collecting and recording data.
8. Ask each group to share their final count per temperature zone on their group sheets and graph the data.
   * Optional page 2: Compute the averages for each of the temperatures by dividing each total by the number of groups.
9. Graph the results.
   * Optional: Upper grade students may compute the percentage found in each temperature zone and graph the results.

IX. Discussion Question
Were the results consistent throughout the room? If not, what are some possible variables that could have caused these differences?

X. Extended Activities
1. Students may try other "Critters" such as: night crawlers (earthworms), snails, mealworms.
2. Students may place equal number of critters in each temperature area and see how many are in that area after 5 minutes.

XI. Curriculum Coordinates
Math:
1. Upper grades — compute the % of critters in each temperature group.
2. In which 2 minute period was there the least amount of change in the number of critters in the *cold* temperature? Hot temperature? Room temperature?

Language:
Write a short commentary on what a small critter might say while choosing the best temperature to live in.

Science:
Research one of the following: mealworms, sow bugs (isopods), night crawlers (earthworms).

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Name _____

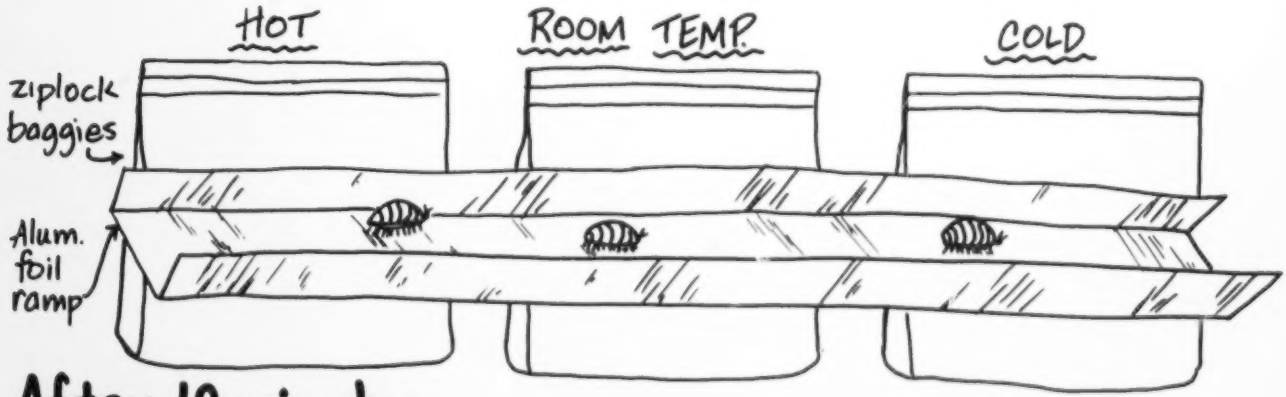
Hot Foot, Cold Feet

Question: What temperature do isopods prefer, hot, room temperature or cold?

Hypothesis: _____

_____

Number of Critters: _____



After 10 minutes I predict: # in Hot: _____ # in Room Temp.: _____ # in Cold: _____

Time:	Hot	Room Temp.	Cold
2 min.			
4 min.			
6 min.			
8 min.			
10 min.			

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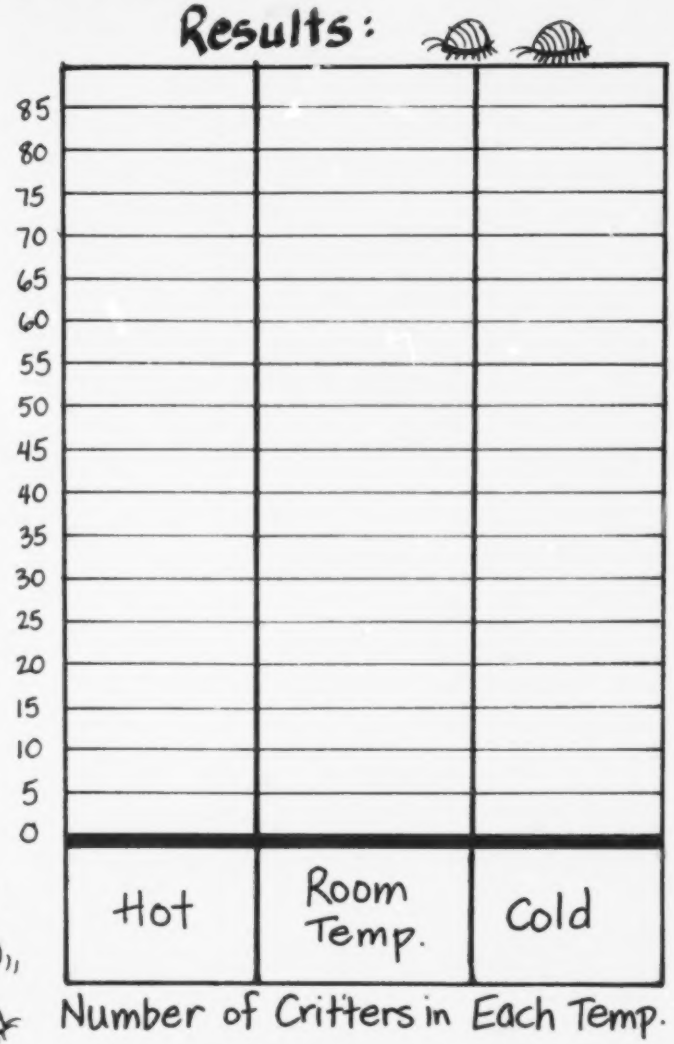
HOT FOOT, COLD FEET

Group Tally Sheet

of Critters After 10 Minutes

Group #	Hot	Room Temp.	Cold
# 1			
# 2			
# 3			
# 4			
# 5			
# 6			
# 7			
# 8			
Class Totals			

Results:



Number of Critters in Each Temp.

Conclusion: _____

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HOT FOOT, COLD FEET

Group Tally Sheet

1 # of Critters After 10 Minutes

Group #	Hot	Room Temp.	Cold
# 1			
# 2			
# 3			
# 4			
# 5			
# 6			
# 7			
# 8			
Totals:			
÷ # of groups			
Average			

3 % of Critters in Each Temp.

Hot	Room Temp.	Cold

2

Number of critters in each Temp.	÷	Average Total # of Critters	=	Decimal Value	X	100	=	%
Hot ____	÷	_____	=	.____	X	100	=	____%
Room Temp. ____	÷	_____	=	.____	X	100	=	____%
Cold ____	÷	_____	=	.____	X	100	=	____%

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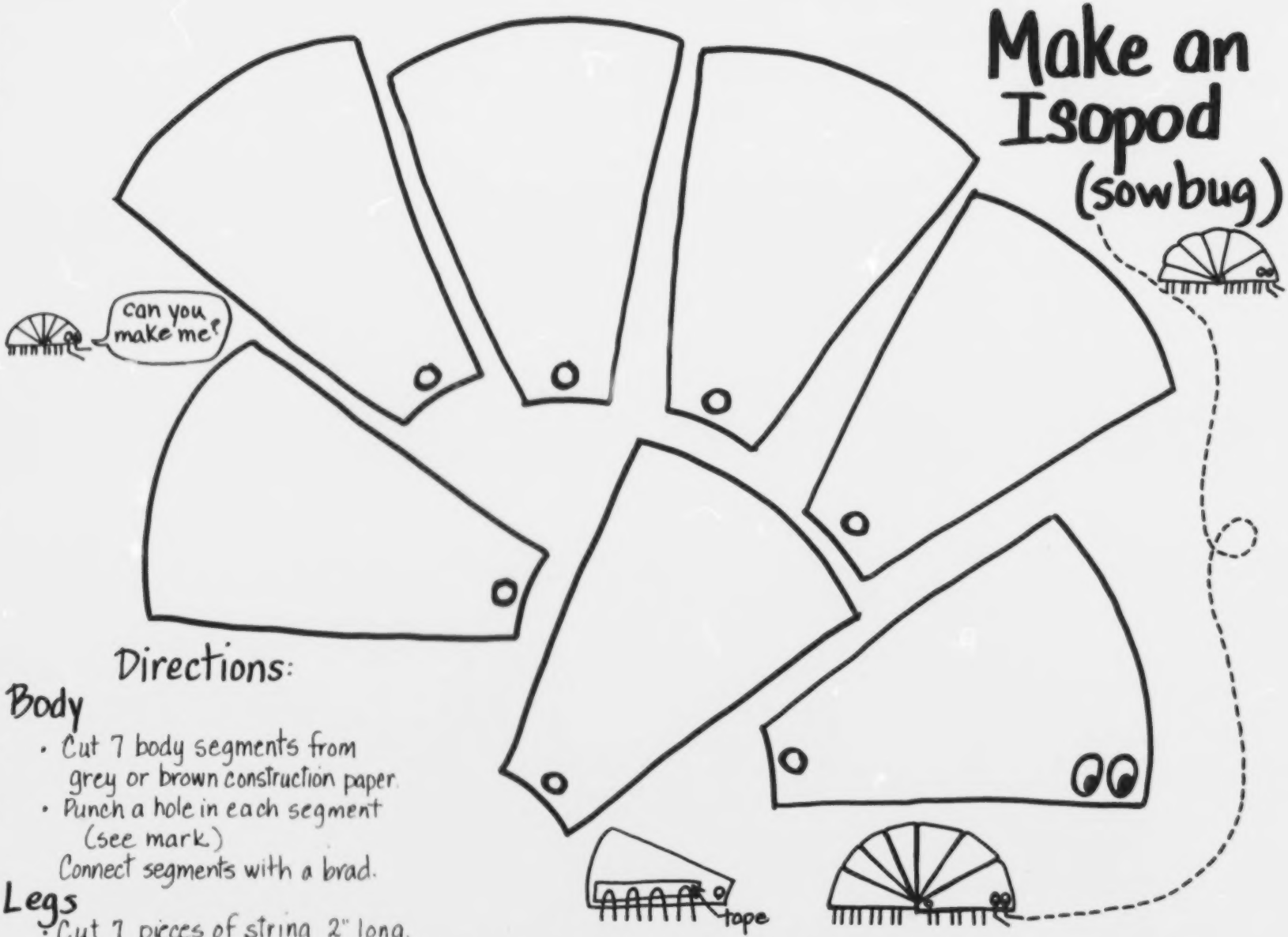
Make an Isopod (sowbug)



Directions:

Body

- Cut 7 body segments from grey or brown construction paper.
- Punch a hole in each segment (see mark)

Connect segments with a brad.

Legs

- Cut 7 pieces of string 2" long.
- Double over each piece of string and tape 3 loops, evenly spaced, to the underside of the front section and 4 loops to the underside of the last segment.

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FISHFUL THINKING

I. Topic Area
Observation of goldfish

II. Introductory Statement
Students will draw a goldfish before and after observing one.

III. Math Skills
a. Computation

Science Processes
a. Observation

IV. Materials
drawing paper or activity sheet for each student
crayons
goldfish in an aquarium or in cups or jars

V. Key Question
What does a goldfish look like?

VII. Management Suggestions
Keep the goldfish out of sight until students have drawn the first picture. After the picture is drawn give the students ample opportunity to observe the goldfish before having them draw the second picture. It is best if each group has a goldfish in a jar or cup at their table.

VIII. Procedures
1. Give the students the activity sheet or a sheet of drawing paper. Ask them to fold it in half width wise and draw a line across the fold.
2. Students draw a goldfish in the top half of the paper. (Give no directions or clues of what to include).
3. Bring out goldfish in an aquarium or jars for the class to observe. Allow students to watch the goldfish throughout the day. Be sure to observe them at feeding time. After ample observation discuss what goldfish really look like and point out the various parts, such as gills, scales, fins, etc.
4. Have students draw another goldfish picture on the bottom half of drawing paper or activity sheet.
5. Compare the two drawings.
6. Students count how many new parts they included in the second picture. Record that number in the box in the lower left-hand corner.
7. Students can list the ways the two drawings are alike and the ways they are different in the blanks provided.

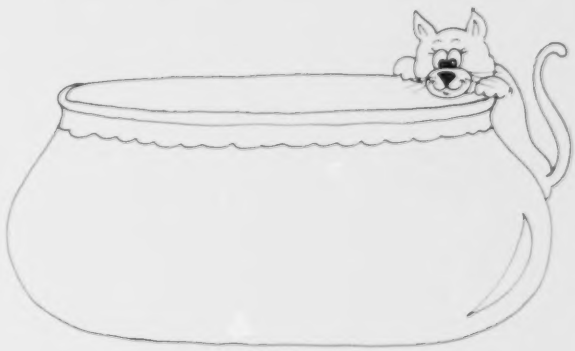
IX. Discussion Questions
1. How did your second picture compare to the first one?
2. Do you think it improved? Why?

X. Extended Activities
Draw other animals and redraw them after observing the actual animal or a photograph.

XI. Curriculum Coordinates

Art:
Make fish out of clay.

Language:
Write a poem about the body of a fish.



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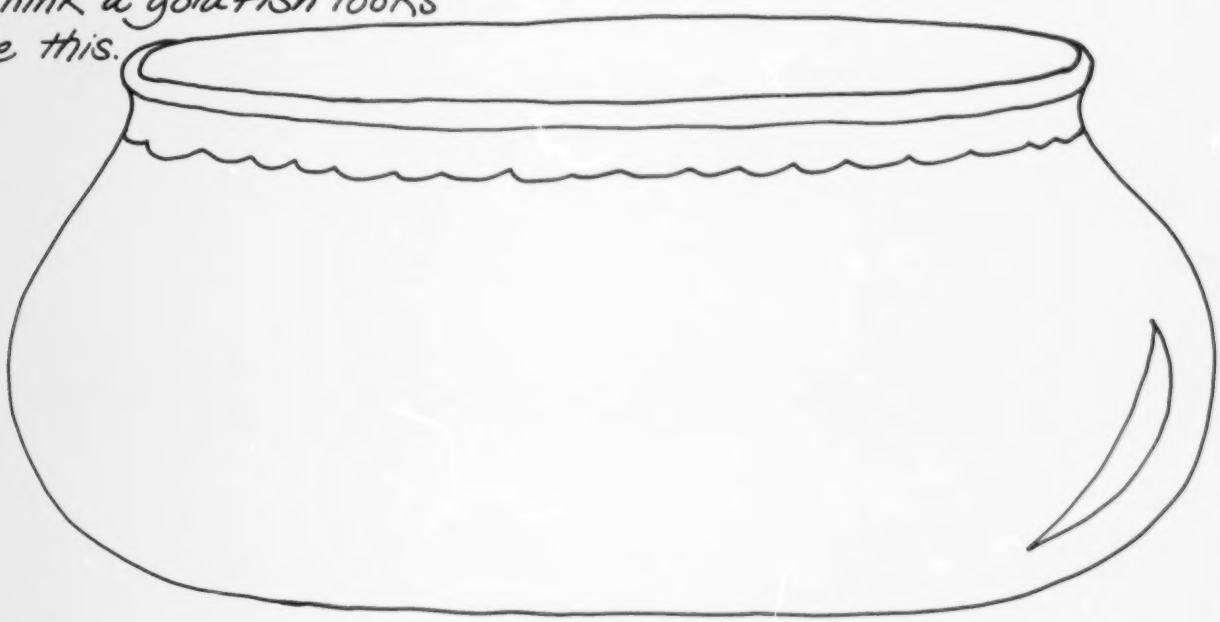
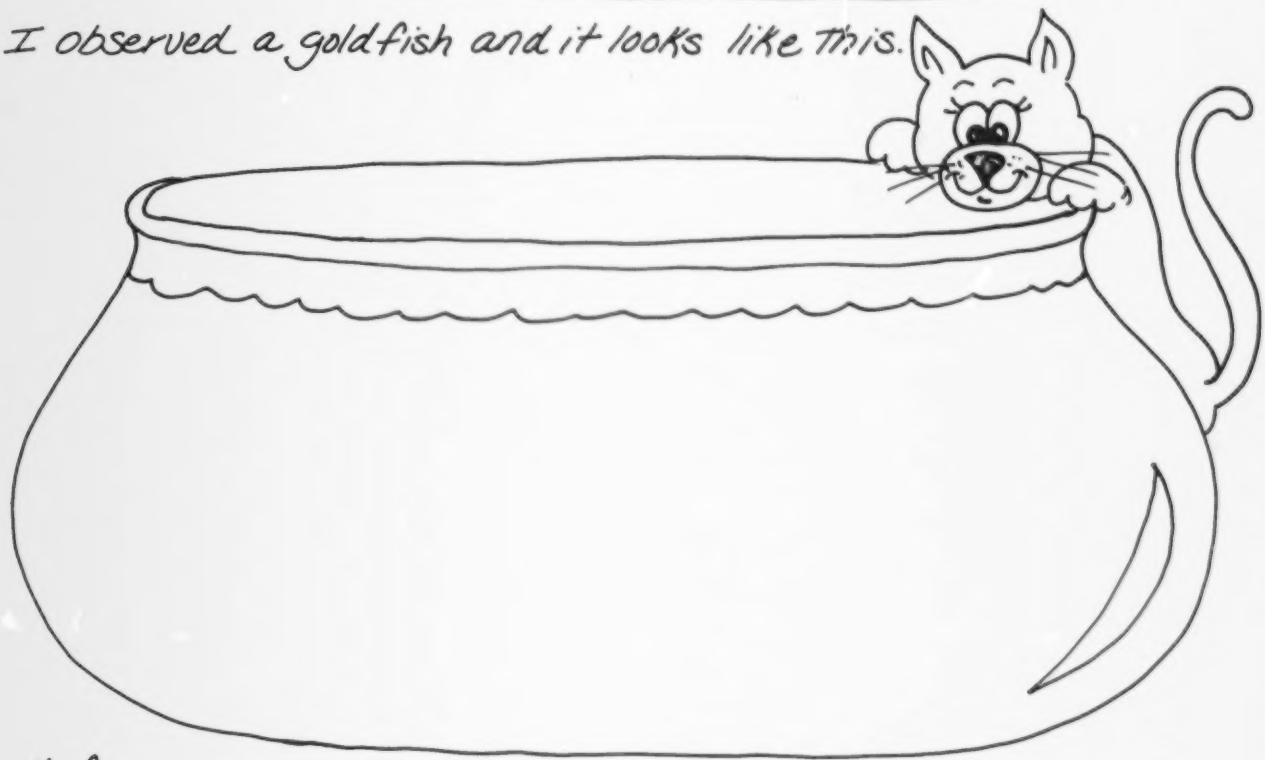
Fishful Thinking

Name _____

I think a goldfish looks like this.



I observed a goldfish and it looks like this.



# of differences

How are the pictures alike? _____

How are they different? _____

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FISHING FOR FINS

I. Topic Area
Fish anatomy

II. Introductory Statement
Students will construct a goldfish model that shows all its fins and simulates its breathing.

III. Math Skills **Science Processes**
a. Observing
b. Classifying

IV. Materials
activity sheets
crayons
scissors
live goldfish for observation
tape or glue

V. Key Question
How does a fish swim and breathe under water?

VI. Background Information
Fish breathe by taking dissolved oxygen from water. Fish gulp water through their mouths and pump it over their gills. Most fish have four pairs of gills covered by the operculum. The gills absorb oxygen from the water and replace it with carbon dioxide. Fins are movable structures that help a fish swim and keep its balance. The fins found on the top, underside, and tail (the dorsal, anal, and caudal) help the fish remain upright. The caudal fin propels the fish through the water. The pectoral and pelvic fins are located just behind the gills (with the pectoral fins on top) and are used to turn and stop. The lateral line runs the length of the body and plays an important role for fish as a sensing organ. Fish have no external ears and the lateral line, which has delicate nerve endings all along its length, senses vibrations and movement in the water, thus allowing the fish to "hear."

VII. Management Suggestions
Use the activity sheet to make a working model of the fish, for demonstration purposes, before beginning the activity.

VIII. Procedure
1. Have students observe a goldfish for 5–10 minutes asking them to locate the various fins.
2. Discuss the function of each fin. (See Background Information)
3. Ask how fish are able to breathe under water.
4. Accept answers and elaborate by using an assembled model as a visual aid.
5. Pass out the activity sheet and have students cut out the water strip and fold the bottom ⅔'s of it over along the dotted line. Have them label the empty side of the strip with the formulas H_2O (water) and CO_2 (carbon dioxide). This side represents the water composition after it goes through the gills.
6. Have students assemble their own fish models by gluing or taping the fins and lateral line in the appropriate locations. Students may cut out the fish or cut off the top half of the page at the solid line. Insert the water pull strip through any one of the four gill slits. Pull the strip through the gills to simulate the fish breathing.

IX. Discussion Questions
1. How is this form of breathing different from our own?
2. Think of some other animals that breathe with gills.
3. Why do you have to change your goldfish's water if you have no air pump in your fish bowl?

X. Extended Activities
1. Research fresh water and salt water fish for similarities and differences.
2. Observe isopods or tadpoles to see how they use their gills.

XI. Curriculum Coordinates

Art:
Make fish prints using a fish from the market. Paint or ink the surface of this fish and place blank newsprint over the fish. Press the paper onto the fish with your hand and remove the completed print.

Science:
Compare fish and whale fins.

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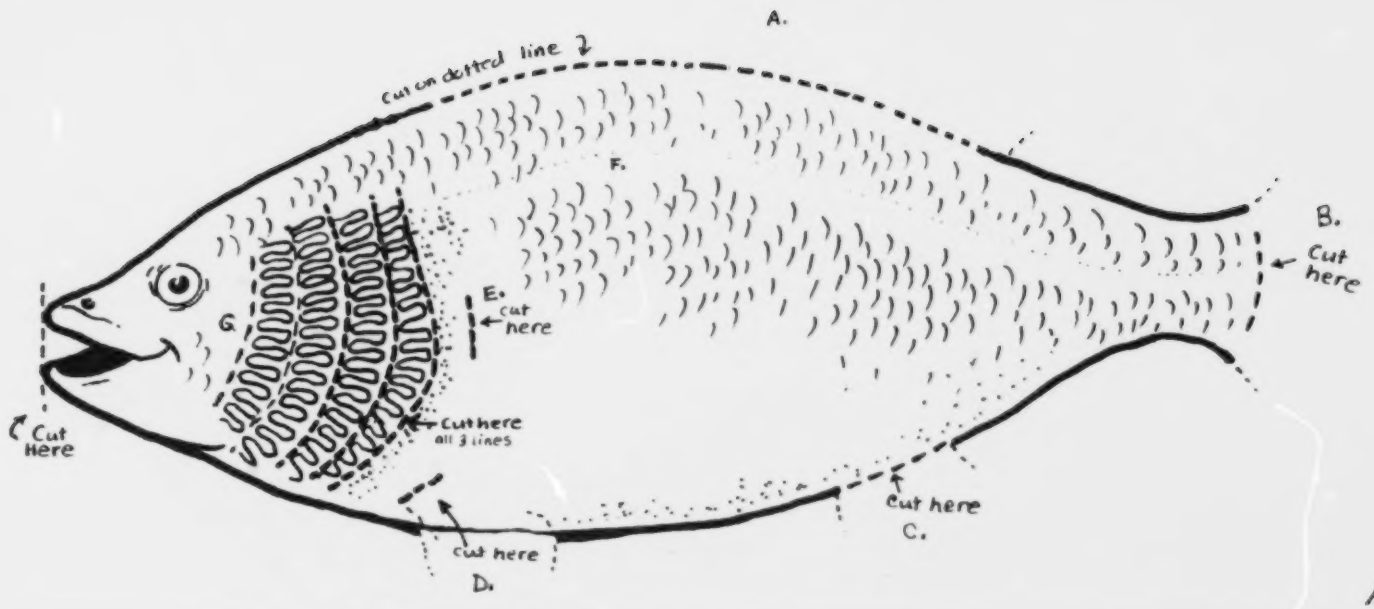

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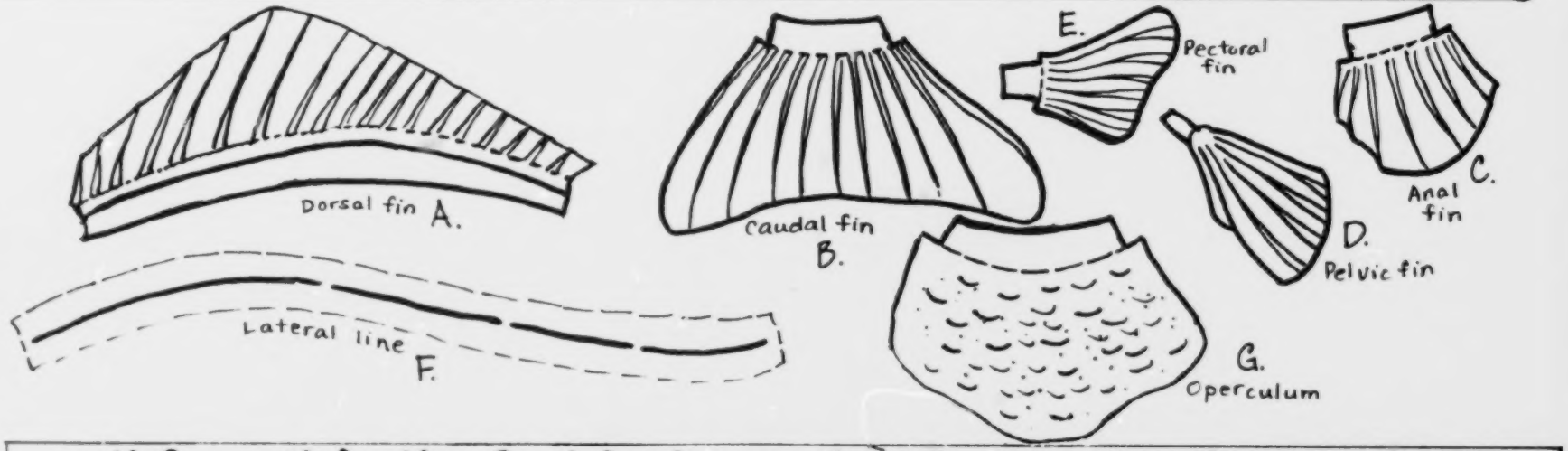

H_2O O_2 H_2O H_2O O_2 H_2O H_2O O_2 H_2O O_2 H_2O H_2O O_2 H_2O O_2 PULL HERE ➡

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BRINE SHRIMP

I. Topic Area
Brine shrimp

II. Introductory Statement
Students will observe and study brine shrimp as they hatch and grow.

III. Math Skills **Science Processes**
a. Observing
b. Collecting & recording data
c. Generalizing

IV. Materials
brine shrimp kit
glass jars
activity sheets
hand lenses
glass eyedroppers

V. Key Question
How will brine shrimp grow and change over a period of several weeks?

VI. Background Information
See the brine shrimp booklet. The brine shrimp kit also has information.

VII. Management Suggestions
1. Brine shrimp eggs and the instructions and materials needed to hatch them are available in most pet stores in inexpensive kit form. Most kits contain three packages; one containing the eggs, one containing the salt mixture to be added to water, and a package of food.
2. Students can work in groups on this activity.
3. Gather enough jars beforehand so that each group has at least one. Large baby food jars or jam jars work well.
4. Students will be doing this activity for a short time every three days for a period of several weeks.
5. Prepare the brine solution from the kit according to the directions enclosed. The solution should be made before doing this lesson with students. If you mix your own saline solution, *do not* use iodized salt.
6. Not all eggs will hatch, so each group should be given 10–15 eggs. The eggs hatch quite quickly once placed in the brine solution.
7. The glass eyedroppers can be used to catch one or two brine shrimp from the jar for closer observation. Hand lenses also make observing the tiny shrimp easier.
8. The second activity sheet is designed to be made into a flip book. The dot on each one of the jars is there to serve as a reference point for the student drawings.
9. The students may want to cut up the second activity sheet and staple it into a flip book before starting their observations and drawings.

VIII. Procedure
1. Fill the jars with brine solution and pass one out to each group.
2. Have each group count out 10–15 eggs and place them in their jar.
3. Pass out the first activity sheet and make the brine shrimp booklet by folding the sheet in half and then in half again. Read and discuss the booklet together as a class.
4. Pass out the second activity sheet. Have students draw a picture of the brine shrimp egg next to the dot in the first jar.
5. Explain that a picture will be drawn every three days showing the growth of the brine shrimp.
6. When the brine shrimp eggs hatch have students use the eyedroppers and hand lenses to examine them closely and draw a picture in the next bottle on the activity sheet. The dots on the jars drawn on the activity sheet are to be used as reference points for drawing pictures of the shrimp. The shrimp should be drawn in the same place relative to the dot each day. For example, the student might choose to have the dot represent a point on the top of the brine shrimp's head and draw a picture each day underneath the dot. Older students should be challenged to draw the pictures as accurately as possible so that the growth and changes can be evidenced through the series of pictures.
7. Older students should attempt to keep an accurate record of the shrimp's growth on the back of the activity sheet detailing length in millimeters, color, swimming methods, etc.
8. Students will continue the observations for a period of 3–6 weeks.
9. The activity sheet can be cut apart when it is completed and the pictures stapled in sequence to make a flip book of the shrimp's growth.

IX. Discussion Questions
1. How fast did your brine shrimp grow?
2. What things did you observe as your brine shrimp grew?
3. Can you see important organs and body parts in your brine shrimp?
4. Can you tell the difference between male and female brine shrimp?
5. Did you observe the skins shed by the brine shrimp?

X. Extended Activities
1. Use an eyedropper to catch a brine shrimp and put it on a slide. With a low power microscope, observe your brine shrimp more closely.
2. Keep a classroom jar of brine shrimp and study their life cycle for a longer period of time.
3. Keep track of the number of eggs put in the brine solution and the number of shrimp that actually hatch.
4. Test your brine shrimp's reaction to changes in light, temperature or salinity.

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BRINE SHRIMP

Brine shrimp are tiny crustaceans that live in salty lakes and along a few coastal areas around the world. They are related to crabs, lobsters and water fleas.

They eat saltwater algae and bacteria. Brine shrimp are used as food for small aquarium animals.

The female Brine shrimp are larger. Their egg sac is at the point where the body and tail meet. Eggs can be laid every 4-5 days, depending upon the food supply. Dried eggs can be saved in a cool place for long periods of time.

When Brine shrimp hatch, they are the size of a period ".". They double in size in one day.

Brine shrimp do not have any bones. Their outer covering is their skeleton. To grow, they cast off their skeleton and grow a new, larger one. They do this about 12 times until they reach adulthood.

Larva

Brine shrimp grow to be about 12 mm (½") long. They have 10 to 30 pairs of "swimming limbs" that beat 150 to 208 times per minute.

Adult

The swimming limbs point upward because they are sensitive to the light. These limbs are used to filter food particles from the water.

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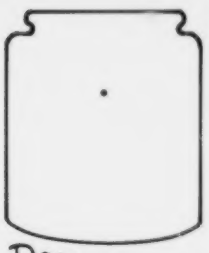
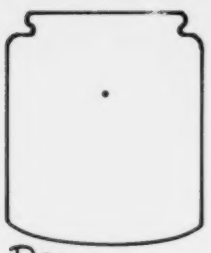
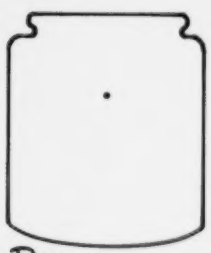
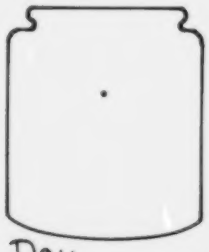
CRITTERS

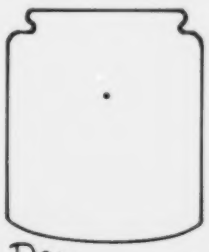
Brine Shrimp This is Your LIFE !

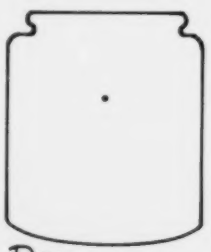


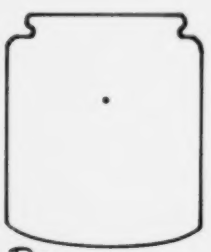


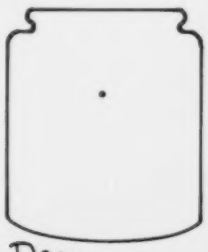


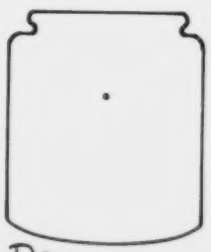


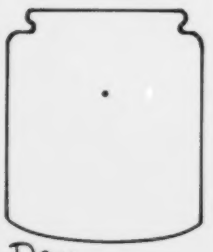


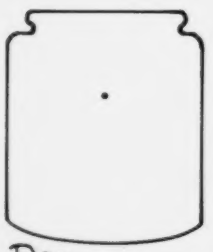


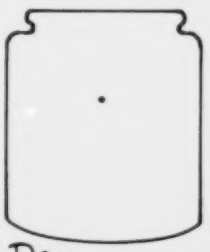


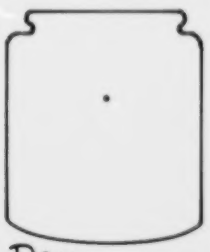


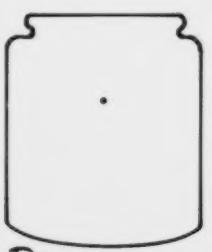












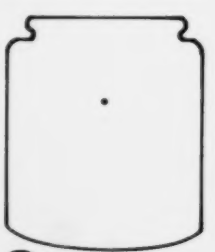


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TABLE MANNERS

I. Topic Area
Insect mouthparts

II. Introductory Statement
Students will simulate food gathering with four different types of insect mouths.

III.

Math Skills	Science Processes
a. Measuring	a. Observing
b. Graphing	b. Predicting
	c. Collecting data
	d. Classifying

IV. Materials
Per group of 4:
Mouthparts: 1 flex straw, 1 regular straw with one end cut diagonally to form a point, 1 clothespin, 1 clothespin attached to a small piece of sponge about 1" x 1"
Food sources: paper torn and crumpled into small pieces, 1 narrow necked bottle containing water, 1 cup containing water and covered with a paper towel or plastic wrap taped securely over its opening, 1 tuna can or small bowl containing water
Collection apparatus: 4 plastic or paper cups
Measuring devices: graduated cylinders or measuring cups (optional)

V. Key Question
How are insects adapted to eating certain types of food?

VI. Background Information
An adaptation is any characteristic that helps an organism survive. The adaptation may be in the organism's physical appearance, the way its body functions or the way it behaves. These changes occur through interaction with living and non-living things in the environment. An insect's mouthparts are a set of structures used for eating. They surround the insect's mouth. There are two basic types of insect mouths and mouthparts, those adapted for chewing and those adapted for sucking. Many insects have variations or combinations of the two basic types of mouths. For example, the mosquito has a piercing-sucking mouth, a housefly has a sponging mouth and wasps and bees have chewing-lapping mouths. Chewing insects have two grinding jaws called *mandibles*. They move sideways and are lined with teeth in most species. The jaws are also used for cutting or tearing off food. They have a second pair of less powerful jaws, called *maxillae*, behind the mandibles that are used to push the food down the throat. They also have two lips or flaps that hang down over the mouthparts and cover the front of the mouth. The upper lip is called the *labrum* and the lower lip, the *labium*. Some examples of chewing insects are grasshoppers, crickets, beetles, cockroaches, and termites. Sucking insects have mouthparts adapted from the basic chewing mouth structure to suit their feeding habits. The labium in some insects has become a long, grooved beak with four slender, sharp needles called *stylets*. Stylets are used for piercing and then sucking up juices or blood. In butterflies and moths, the mandibles have lengthened forming a long drinking tube called a *proboscis*. This tube coils up when the insect is not using it to gather liquids. The mandibles in horseflies have become curved swords that can slash an animal's skin and its maxillae have developed into sharp-pointed rods that can penetrate and extract fluids from the skin.

VII. Management Suggestions
1. This activity can be done in one of two ways. The first activity sheet has students simulating the different types of insect mouthparts and how they work. It is a good activity to do by itself and is appropriate for primary students. It could also be done as an introductory lesson for the second activity sheet. The second activity sheet allows students to do some measuring and graphing. The set up for each lesson is identical except for the inclusion of measuring cups or graduated cylinders in the second activity to quantify the amount of food collected by the mouthparts.
2. This activity is designed to be done in groups of four.
3. Prepare the materials for each group ahead of time. Each group will need the materials listed above.
4. To make management easier, each student should pick one food source and collecting cup to keep for the entire activity. Each student will then use each of the four mouth parts, in turn, to try and collect his "food." It will become obvious that not all the mouth parts work well with all the food sources. For example, the chewing mouth (clothespin) will not work well on anything but the bits of paper, while the straws will not be able to collect the bits of paper. It is important for the students to discuss their experiences with each of the four mouthparts and come to a group consensus as to which mouth is adapted best to each food supply.

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III. Procedure

1. Discuss differences between insects. Focus on methods of eating, different types of mouthparts and various types of food sources.
2. Discuss how different insects have adapted or changed over time to meet environmental changes, food sources, etc.
3. Discuss the different types of mouthparts on various insects that students may have observed.
4. Pass out the first activity sheet. Show each type of mouth and discuss how it works. Show the students the four kinds of food sources.
5. Using a cup of water, demonstrate how to capture liquid in a straw with your finger. **Note:** Caution students not to use their mouths to suck up liquid in the straw. To capture liquid in the straw, lower it into the liquid and place your finger on top of the straw, trapping the liquid inside. To release the liquid, lower the straw into a "collecting cup" and remove your finger from the top of straw, releasing the liquid. Explain that the piercing-sucking mouthpart (the pointed straw) is the only one that should be used to break through the paper towel or plastic wrap on the covered cup.
6. Pass out a small collecting cup to each student to collect the food gathered by each mouthpart.
7. All students will use all four mouthparts during the lesson, but keep the same collecting cup and food supply.
8. Discuss the activity sheet and have students fill in their predictions as to which mouth is best suited to each food supply. Explain the mechanics of the lesson. Each "feeding period" should be about two minutes.
9. After students have tried each of the four mouth parts to collect their food they need to discuss their observations and come to a group consensus as to which mouth is best adapted to each food source. The students can then fill in the rest of the activity sheet from their observations.
10. The activity can be repeated at a later time using the second activity sheet and having the students count and measure the amounts of each food that the mouthparts collect.

IX. Discussion Questions

1. How does an insect's mouth affect its choice of food?
2. What would happen if all insects had the same type of mouthparts?
3. Where would you look for an insect that had a "sucking" type of mouth? Chewing? Piercing/Sucking? Lapping?

X. Extended Activities

1. Make a list of insects that have each type of mouthpart. Which is the most common type?
2. Discuss how mouthparts relate to where an insect lives.
3. Look up insects in the encyclopedia and draw and label the different types of mouthparts.
4. Design insect mouthparts that would be good at collecting a common food item, such as sugar or fruit.

XI. Curriculum Coordinates

Science:

What kinds of adaptations for eating do mammals have? What about reptiles, birds, amphibians and fish?

Math:

Test each mouthpart again allowing a feeding period that is twice as long. Did you eat twice as much?

Geography:

Identify as many insects in your area as possible. Are there more insects with one particular kind of mouth? Identify the food source for each insect.

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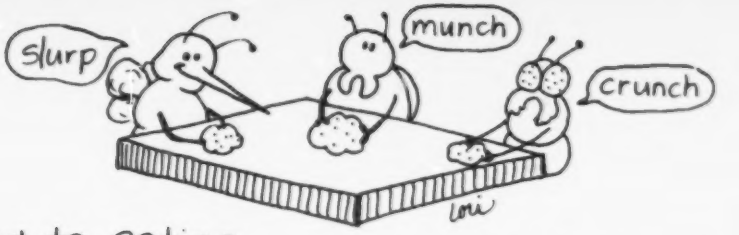
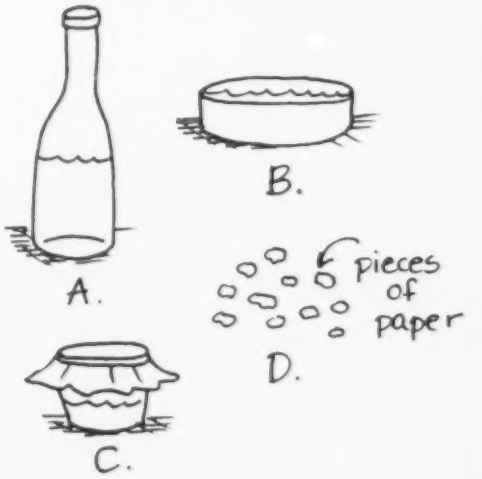
Table Manners



Question: How are insects adapted to eating certain types of food?

Mouthpart:	Prediction: Best Food Source	Actual: Best Food Source
1. Chewing:		
2. Sucking:		
3. Piercing/Sucking:		
4. Sponging/Lapping:		

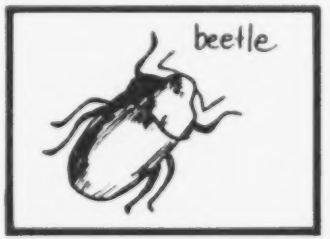
Food Sources

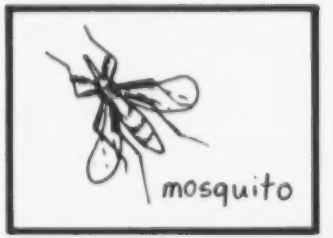


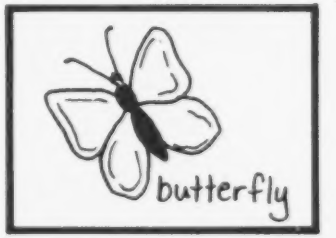
Conclusion: _____

_____

Label each type of mouthpart for the following insects.

1. 

2. 

3. 

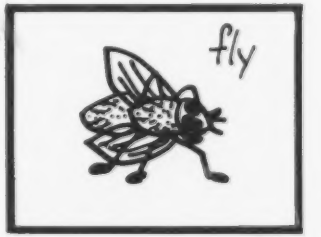
4. 

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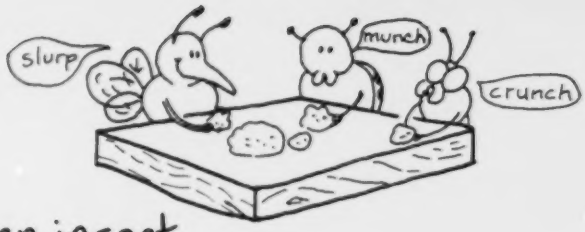
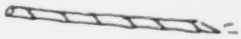
Table Manners



Question: Which mouthpart of an insect will gather the most food?

Prediction: _____

Mouthpart:	Total Food Eaten:
1. Chewing:	_____ pieces
2. Sucking:	_____ ml
3. Piercing/Sucking: 	_____ ml
4. Sponging/Lapping:	_____ ml

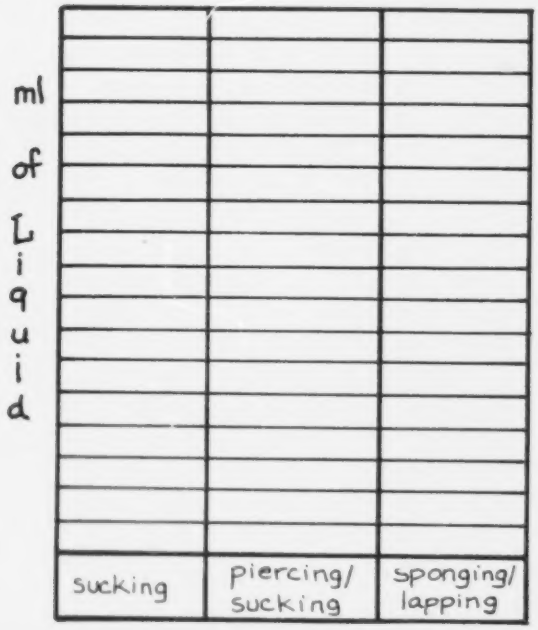
Collection Cups:

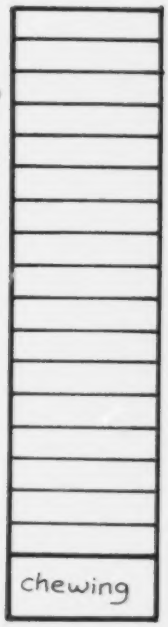
chewing pieces

sucking

piercing/sucking

sponging/lapping





What do you think?

1. Which mouthpart did you find the easiest to use? Why?

_____

_____

2. Which mouthpart was the most difficult to use? Why?

_____

_____

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UNDER COVER

I. Topic Area
Animal coverings

II. Introductory Statement
Students will explore the various kinds of animal coverings.

III. Math Skills
a. Counting
b. Graphing

Science Processes
a. Observing
b. Classifying
c. Comparing

IV. Materials
soft material to simulate fur or hair collected from pets
feathers
waxed paper
net bag
popsicle sticks
tape and glue
crayons and scissors
activity sheets

V. Key Question
How are animal coverings different?

VI. Background Information
Animals have different kinds of coverings that are an adaptation to their environment. Mammals have hair or fur, birds have feathers, amphibians have smooth skins and scales cover both fish and reptiles.

VII. Management Suggestions
1. Fur can be simulated by small patches of soft, fur-like material or by glueing hair collected from pets or a dog groomer onto small squares of paper.
2. Feathers can be purchased or obtained from a feather pillow.
3. Scales can be simulated by cutting small patches from net produce bags (like the ones used for onions or oranges).
4. Squares of waxed paper simulate smooth skin.
5. In sorting and graphing the small animal pictures there are too many animals with fur to fit on the graph. This is an opportunity for student problem solving or the teacher may wish to eliminate two furry animals before the pictures are given to the students.
6. This activity can be done in one or two sessions.

VIII. Procedure
1. Discuss animal coverings. Then pass out the two activity sheets with the four large animal drawings on them and have the students cut them out.
2. Students color in the animals and glue a patch of the appropriate skin covering on each one.
3. Students tape a popsicle stick to the back of each picture making an animal puppet.
4. Students use the puppets to answer questions about animal coverings. For example, the students would hold up the snake puppet if the teacher showed the class a picture of a fish and asked what kind of skin covering a fish has.
5. After the students have a good grasp of what kind of animals have the various coverings, the activity sheets with the covering graph and the small animal pictures may be passed out.
6. Students glue a sample of each of the coverings in the boxes at the top of the covering graph.
7. Students cut out the small animal pictures and glue them in the appropriate squares on the covering graph.

IX. Discussion Questions
1. Discuss why animals need coverings.
2. Discuss the different kinds of coverings and how they meet the needs of the animals.
3. Discuss other coverings not included in this activity, such as the hard shell of a snail or the thick skin of an elephant.

X. Extended Activities
1. Make "feely" bags that simulate the different textures of animal coverings.
2. Children can bring in toy animals to sort according to covering types or to make a class "zoo."

XI. Curriculum Coordinates

Language Arts:
Brainstorm furry things, then write and illustrate "furry" stories or poems.

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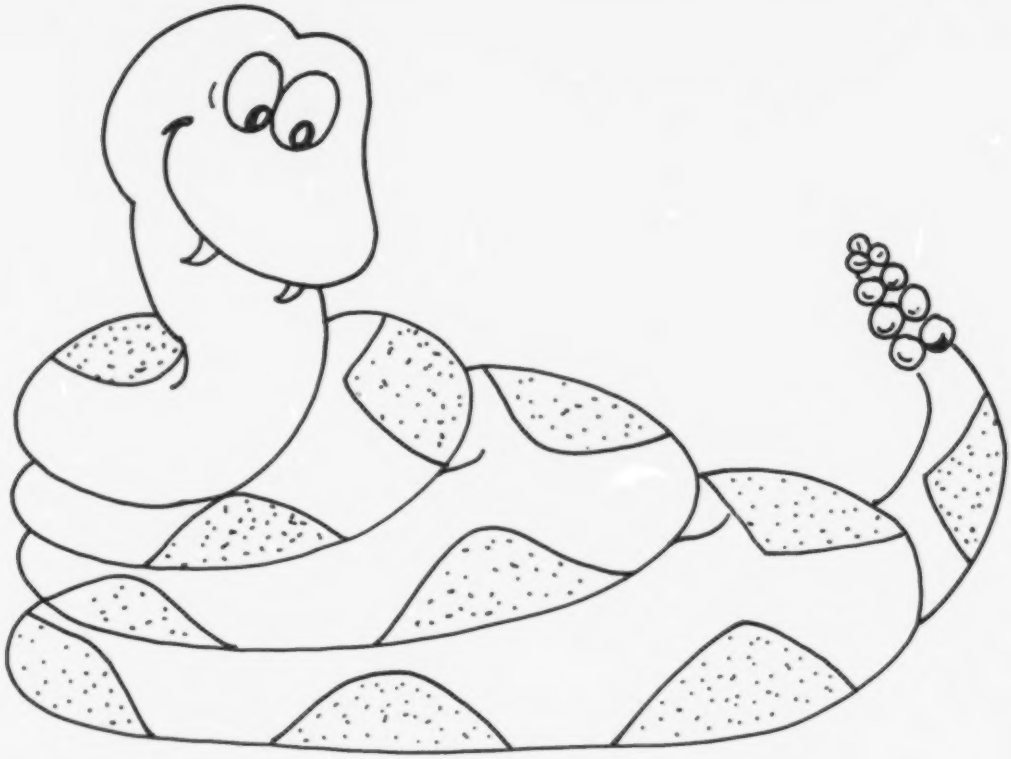
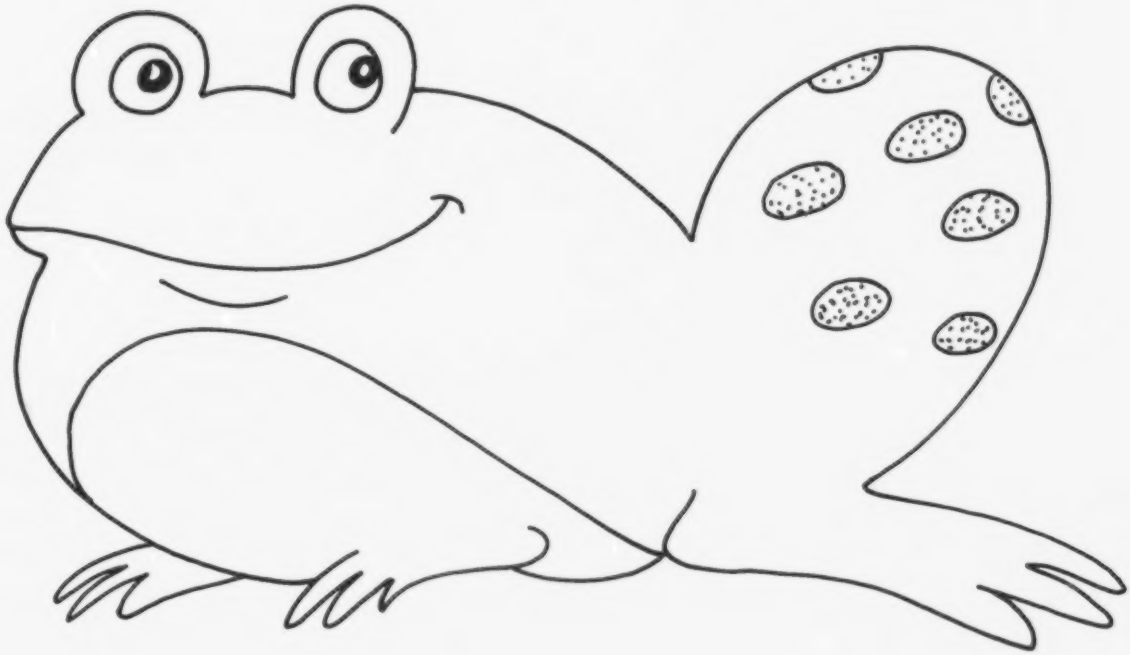
UNDER COVER





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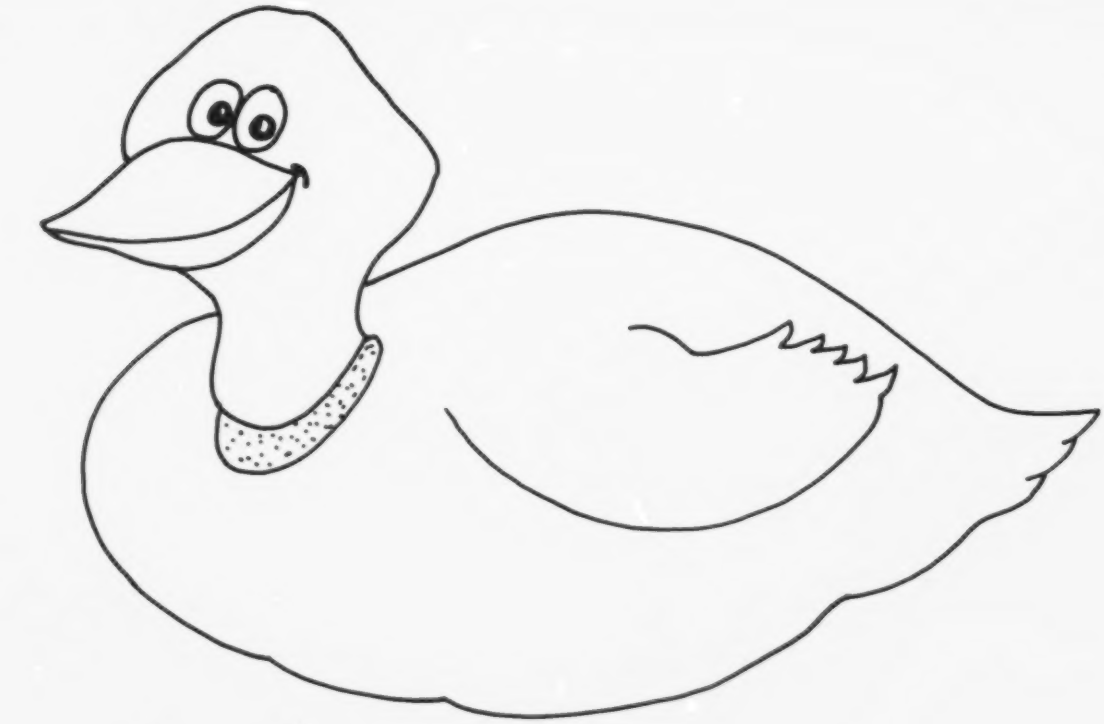

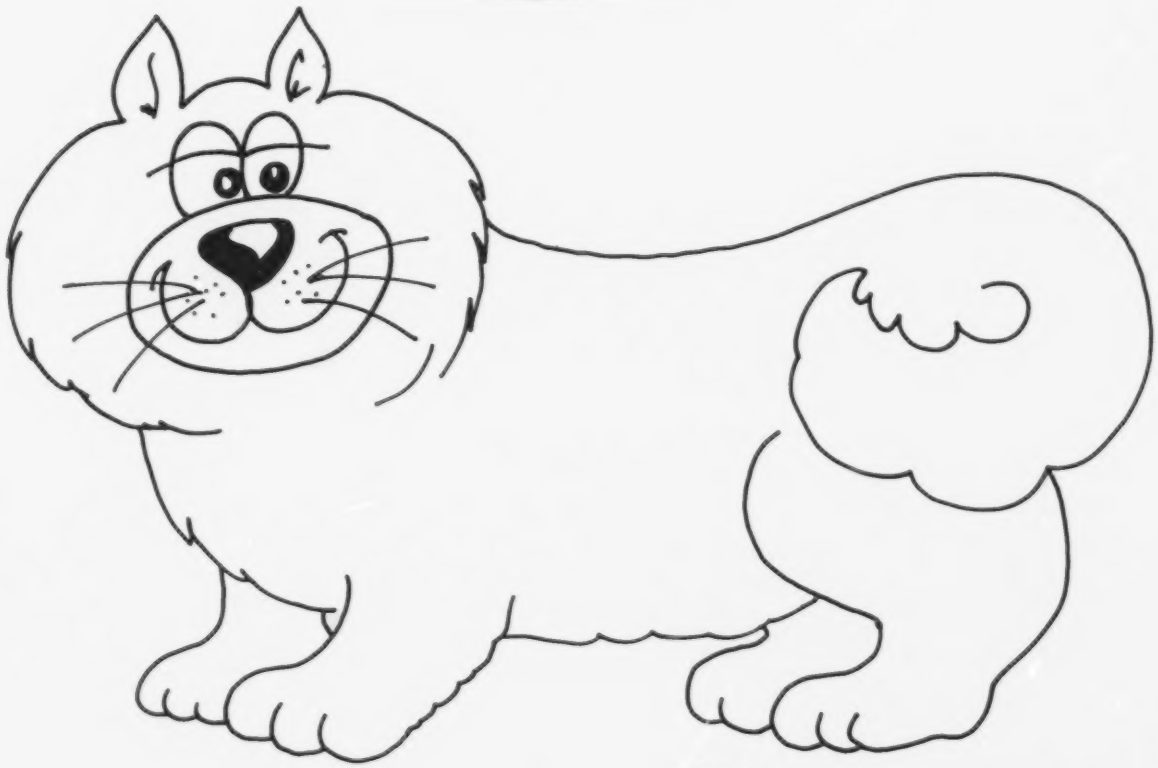

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Name _____

UNDER COVER

FUR	FEATHERS	SCALES	SMOOTH SKIN

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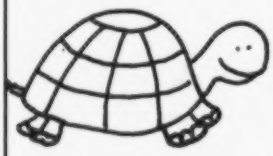
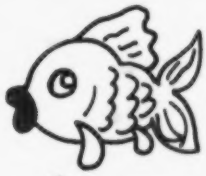
UNDER COVER

monkey	cat	frog	dog
duck	lamb	 turtle	salamander
snake	 fish	lion	dinosaur
bird	rabbit	lizard	chicken

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HIDE AND SEEK

I. Topic Area
Camouflage

II. Introductory Statement
Students will make a critter and see the effects of camouflage on animal visibility.

III. Math Skills
a. Whole number operations
b. Fractions
c. Measurement

Science Processes
a. Predicting
b. Observing

IV. Materials
paint
markers
toothpicks
a variety of objects to build a critter
i.e. egg cartons, paper bags, marshmallows, etc.

V. Key Question
How does camouflage affect a critters ability to survive?

VI. Background Information
Animals use camouflage to protect themselves from predators. Color and body shape are two important variables that enable an animal to blend into its environment. Animals have adapted to the predominate colors in their surroundings. An animal's body shape and size affects its ability to blend into the environment. The patterns of colors on the body covering also affect the animals chances of being seen.

VII. Management Suggestions
1. Be sure to chose beforehand the area where the students can hide their critters. This activity works best if the chosen area is not too large and has definite boundaries.
2. Emphasize that students may not bury the critters.
3. Use tempura paint, markers, or other materials for camouflage.
4. For the critter bodies use paper bags, marshmallows, cardboard egg carton parts, or wads of paper glued or taped together. Toothpicks or sticks can be used for arms and legs.
5. The drawings on the activity sheets include camouflaged critters. Students can locate the critters and color them appropriately.

VIII. Procedure
1. Discuss the key question and activity sheet. Note that the activity sheet is in outline form and is intended to integrate science and language arts.
2. Send students outside to select and observe an environment for their critter within the area chosen for this activity.
3. Record environment information on activity sheet.
4. Keeping environmental information in mind, students create and camouflage a critter from available materials.
5. Record the vital statistics and critter facts on the activity sheet.
6. Have students draw a picture of their critter.
7. Go outside to place critters in their environment. DO NOT BURY CRITTERS!
8. Have students make predictions on the second activity sheet.
9. In small groups students (predators) try to find each others critters. Allow the predators to make one or two sweeps of the area. Set a time limit of a few minutes. The students may enjoy having their teacher be the predator.
10. Students complete activity sheets.
11. Collect all the critters and divide them into two groups making a real graph showing critters found and critters not found.

IX. Discussion Questions
1. Why were you able to locate the critters?
2. Look at the critters in the two groups. What do the critters that were found have in common?
3. What do the critters that were not found have in common?
4. If we were to do this again, how would you change your critter?

X. Extensions
1. Emphasize the use of shapes for camouflage. Use green and brown construction paper.
2. Select a different environment or season and adapt your critter.

XI. Curriculum Coordinates
1. Science: Research animals that use camouflage.
2. Language Arts: Use the "How to Hide A Butterfly" book by Ruth Heller, Grosset and Dunlap Putnam Publishing Group; ISBN 0-148-10478-4.
3. Math: Change fractions to decimals then percentages (see critter fractions activity sheet).

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CRITTERS HIDE 'N SEEK

I. Environment
   A. Colors
      1. _____
      2. _____
   B. Shapes
      1. _____
      2. _____

II. Vital Statistics
   A. Name _____
   B. Height _____
   C. Weight _____
   D. Length _____

III. Critter Facts
   A. Predators _____
   B. Defense _____
   C. Camouflage _____
   D. Food _____

Draw Your Critter

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CRITTERS HIDE 'N SEEK

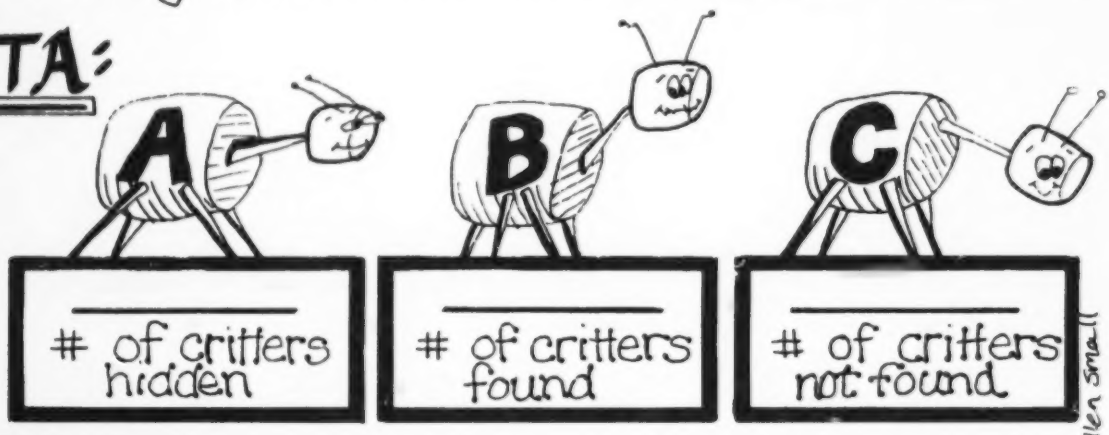
NAME: _____

PREDICTIONS:

How many critters will be found ? _____

How many critters will not be found ? _____

DATA:



FRACTIONS:

Write a fraction to describe the number of critters found and not found.

$$\frac{B}{A} = \frac{\#\text{found}}{\#\text{hidden}} = \_\_\_\_\_$$

$$\frac{C}{A} = \frac{\#\text{not found}}{\#\text{hidden}} = \_\_\_\_\_$$

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CRITTER FRACTIONS

Name _____

critters found	total critters	fraction found	lowest terms
8	12		
14	20		
4	16		
20	36		
6	15		

critters not found	total critters	fraction not found	lowest terms
5	15		
16	24		
9	21		
18	30		
12	24		

Ellen Small

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GONE FISHING

I. Topic Area
Camouflage

II. Introductory Statement
Students will use paper fish cutouts to see the effect of camouflage on prey populations.

III. Math Skills
a. Sequencing
b. Fractions
c. Computation
d. Comparing inequalities
e. Graphing

Science Processes
a. Predicting
b. Gathering data
c. Drawing conclusions

IV. Materials
Per group of four:
12 black fish, 12 red, 12 white, 12 blue
watch with second hand
several sheets of blue paper
activity sheets

V. Key Question
How does the color of an animal affect its population?

VI. Background Information
For many creatures, color is an important means of defense. The blending of an animal into its environment is called camouflage. Camouflage is one way an animal adapts to its environment. The snowshoe hare is white during the winter so that it can blend in with the snow. When the snow melts the color of the hare changes to brown so that it blends into the surrounding during the summer months, too. Some animals blend so well into their surroundings that they are undetectable when motionless, like the walking stick and tomato worm.

VII. Management Suggestions
1. The fish need to be cut out prior to doing this activity. Students can use the pattern at the top of the second activity sheet or cut out their own fish pattern.
2. The fish need to be the same size and shape and are cut from black, red, white and blue construction paper. Each group will need 12 of each for the activity.
3. Make a few extra fish in case some get torn during the activity.
4. Small rectangles of paper (2" × 1") can be used instead of the fish shapes.
5. This activity should be done before doing "Missing Moths" or "Moth Maps."

VIII. Procedure
1. Distribute the activity sheets.
2. Divide the class into groups of four and make sure each group has the cut out fish and 2 sheets of blue paper.
3. The groups will spread the blue paper on a table to act as the fishing pond. The first "fisherman" will turn his/her back to the pond while the other group members spread the 48 fish evenly over the blue paper.
4. Each fishing period will last exactly 10 seconds. The fisherman may only use one hand to pick up fish from the paper. The collected fish may be put in a cup or held in the other hand. The fisherman must attempt to get as many fish as possible in the 10 seconds.
5. The number of each color fish need to be counted and recorded on the activity sheet.
6. The above procedure will be repeated until all four people have had a chance to fish. Make sure that all the fish are replaced before starting each new fishing period.
7. Have the groups share their data and make a data chart on the board. The activity sheets should be completed and the results graphed and discussed.

IX. Discussion Questions
1. Why were some fish caught more than others?
2. How did your group data compare to the class data?
3. How does this activity relate to animals living in their natural evironment?
4. What would happen to snowshoe hares if there was no snow one winter and the ground stayed brown?

X. Extended Activities
1. Use other colors of fish and backgrounds and repeat the activity.
2. Repeat the activity with the same color, but different size fish, to see if size makes a difference.

XI. Curriculum Coordinates

Language:
Write a story about a brown mouse who lived in a white environment.

Art:
Do a camouflage art lesson in which the students draw pictures with objects hidden in them.

Research:
Find other animals that use camouflage.

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GONE FISHING

Name: _____

Counting our Catch

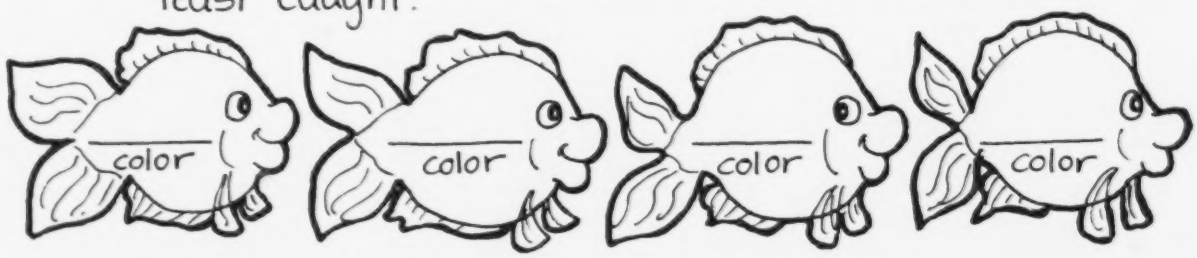
Fisherman

	1	2	3	4	Group Totals	Class Totals
White						
Red						
Blue						
Black						

Looking at our catch

1) Which fish was caught the most? _____ the least? _____

2) Label the fish in order from the most caught to the least caught.



_____ Number caught

_____ Number caught

_____ Number caught

_____ Number caught

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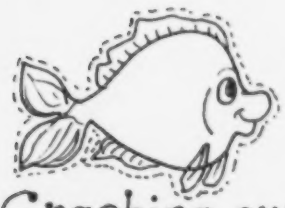
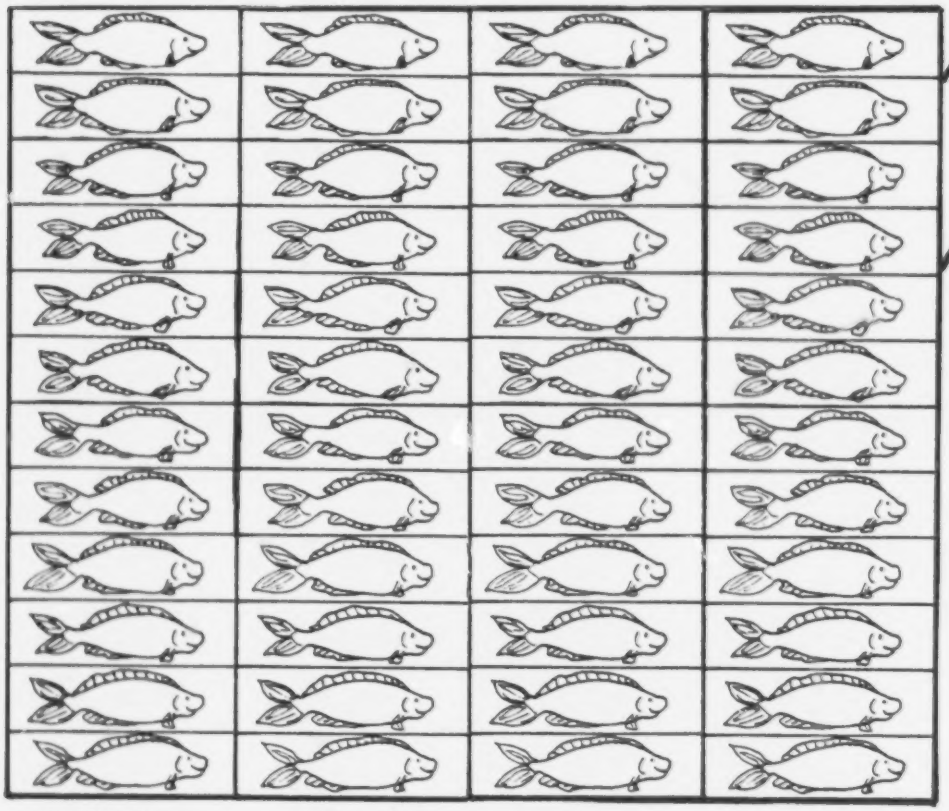
Name _____



GONE FISHING

Graphing our class data

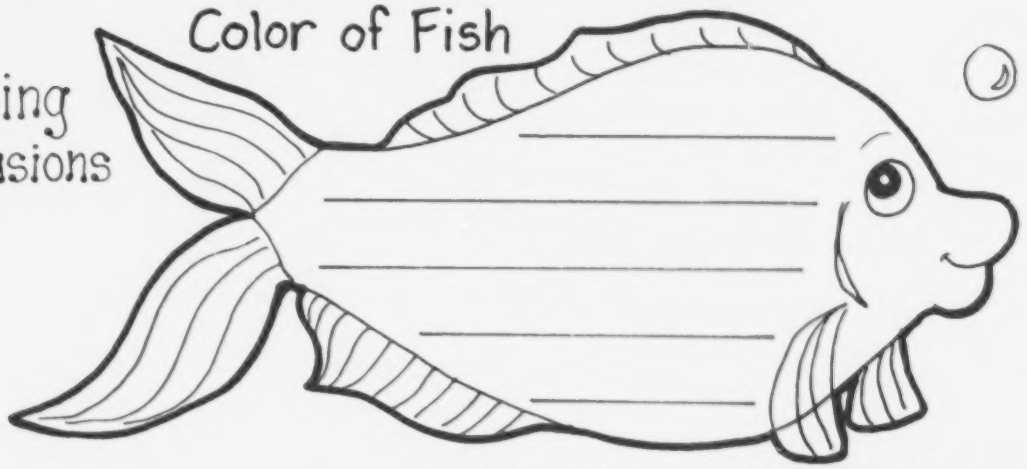
Each fish represents ___ fish.



White Red Blue Black

Color of Fish

Drawing Conclusions



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Name _____

GONE FISHING

	Fisherman's Total	Total # of Fish	Fraction Caught	Fraction Not Caught
		12		
		12		
		12		
		12		

Use >, =, < symbols to record your results.

The fraction of red fish caught is ◯ the fraction of white caught.

The fraction of blue fish caught is ◯ the fraction of black caught.

The fraction of blackfish not caught is ◯ the fraction of red fish not caught.

Now try these... Fill in the blanks.

The fraction of _____ caught is > the fraction of _____ caught.

The fraction of _____ not caught is < the fraction of _____ not caught.

How about this one... Write your own.

_____ ◯ _____.

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MISSING MOTHS

I. Topic Area
Camouflage

II. Introductory Statement
Students will observe an environment with a variety of moths to see the effects of camouflage on animal visibility.

III. Math Skills
a. Estimating
b. Counting
c. Graphing

Science Processes
a. Observing
b. Recording data
c. Concluding

IV. Materials
brown, white and green construction paper
newspaper want ads
moth pattern
activity sheets
glue and tape
scissors and crayons

V. Key Question
How does camouflage affect an animal's ability to be seen?

VI. Background Information
An animal's ability to blend into an environment is called camouflage. Camouflage can be used for defensive or offensive purposes. A rabbit uses camouflage to hide from predators. A mountain lion uses it to hide until a prey is close enough to attack. Animals can be camouflaged by both color and shape. A walking stick is an example of this. Its shape and color make it appear to be part of a tree branch. One of the most dramatic cases of an animal's response to a changing environment is the sphinx moth of England. The sphinx moths that lived near Manchester were light colored so that they blended into the light colored bark of the surrounding trees. Prior to 1850 the vast majority of the moths were light colored. By 1894 95% of the sphinx moths were dark colored. This change occurred because of the environmental effects of the industrial revolution. The local industries were burning large amounts of fuel that produced a new phenomenon, air pollution. The vegetation became coated with this pollution and turned darker in color. The light colored moths became highly visible on the darkened trees and were easy targets for their predators. In 1848 the first black moth was captured, and in 47 years successive populations of moths had changed their color to adapt to the darker environment. The darker moths are presently more populous than the lighter ones. However, due to ecological efforts and the use of cleaner fuels, the light colored moth is beginning to make a comeback. This case is unusual because coloration changes generally occur over a much longer period of time. This example clearly illustrates man's impact on the environment.

TIME LINE

Industrial revolution			*Environment improves*
1800	1850	1900	1950
All moths are light	First dark moth found	Most moths (95%) have become dark	Light moths increasing

VII. Management Suggestions
1. Before doing the lesson you must prepare the "moth environment." To do this tape two sheets of want ads together. Be sure the pages are covered with small print. Use the moth pattern next to the title to cut out and randomly glue brown, green, white and newsprint (cut from the want ads) moths onto the two sheets. The numbers of each kind of moth may vary.
2. You may want to cut the newsprint moths out of another identical page of want ads and glue them in the exact position from which they were cut out, making them very well camouflaged.
3. Laminate the sheets if desired.
4. This activity should be done after "Gone Fishing." Doing it before will adversely affect the results of "Gone Fishing."

VIII. Procedure
1. Before the students arrive, place the newspaper with the moths glued to it on a wall, bulletin board or chalkboard in the front of the classroom and cover it with a sheet of butcher paper.
2. To begin the lesson tell the class that you have a page of paper moths under the butcher paper. Their task will be to look at the paper for 10–15 seconds and estimate the total number of moths and the number of different kinds (colors) of moths.
3. Pass out the student activity sheet. Tell the students not to color the large cut out moth.
4. Remove the butcher paper and allow students to observe the paper for 10 seconds. Re-cover it with the butcher paper.
5. Have the students complete the first section by recording their estimates of the number of types of moths and the total number of moths they saw. Discuss their estimations.

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6. Uncover the paper and count the actual number of types and the total number of moths. Record this data in section two of the activity sheet.
7. Discuss how the predictions and results compared. Because of camouflage, many students may not have seen the newsprint moths. This should be related to how animals depend on camouflage to help them survive.
8. Complete section three by having the students count and record the number of each type of moth.
9. Complete the bar graph by asking the students to raise their hands when you call out the color of the moth that was easiest for them to see. Record this data on the board and have the student color in the graph accordingly.
10. Have the students cut out the moth in the top part of the activity sheet.
11. Tell them that they are going to choose a spot in the room to place (tape) their moth.
12. Each student will select a place and color their moth so that it blends into that location and is camouflaged. Encourage students to consider both the colors and the patterns in the area they choose.
13. The students leave the class and re-enter one at a time and tape their moth to its location.

    Note: Moths must be in plain sight and not be placed under anything.
14. All students return and look around to see how many moths they can see.
15. Tell students the story of the sphinx moth from the background information.

IX. Discussion Questions

1. Which moths were the most camouflaged? The least?
2. What would happen if the background had been red? black? white?
3. How does this example relate to animals in a forest?
4. Why are different moths more easily seen by some of our class?
5. Which moths were not found in our classroom? Why?

XI. Curriculum Coordinates

Art:

Use cutouts to make a camouflage collage.

Language:

Write a letter to a brown moth explaining why it would not be a good idea to move to a red plant.

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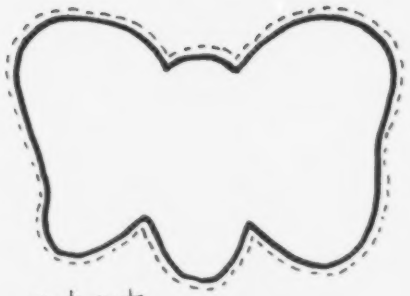
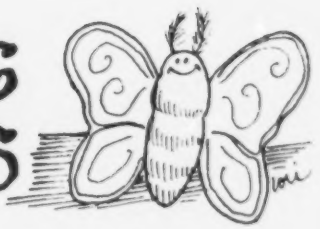


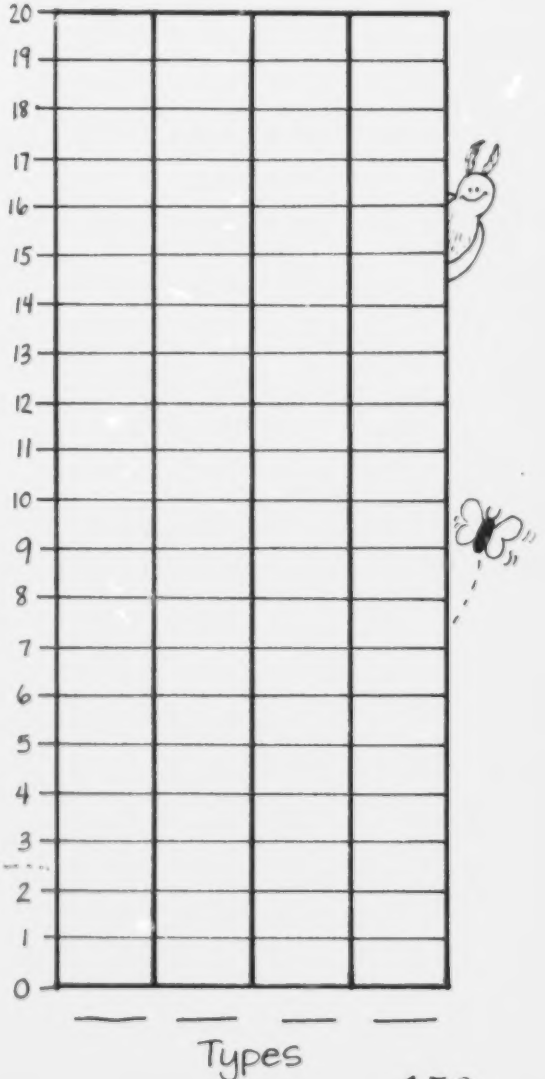
cut out

MISSING MOTHS



Name _____

The easiest moth for our class to see.



① Types of moths: Estimate: _____

Total Number of moths: Estimate: _____

② Types of moths: Actual: _____

Total Number of moths: Actual: _____

③ Actual number of each type of moth?

#1 _____ #2 _____ #3 _____ #4 _____

④ Circle the type of moth that was easiest for you to see.

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MOTH MAPS

I. Topic Area
Camouflage

II. Introductory Statement
Students will try to locate moths camouflaged on a coordinate grid and map their location.

III. Math Skills
a. Estimating
b. Graphing
c. Coordinate mapping
d. Computing (fractions, decimals, percentages)

Science Processes
a. Observing
b. Collecting & recording data
c. Concluding

IV. Materials
construction paper (brown, white, green, other colors optional)
newspaper want ads
large ruler and marking pen
activity sheets
glue and tape

V. Key Question
How does a moth's color affect its ability to be located on a coordinate map?

VI. Background Information
See background information for "Missing Moths."

VII. Management Suggestions
See management suggestions in "Missing Moths."

VIII. Procedure
1. Make the want ad sheet "moth environment" as described in "Missing Moths." Divide the paper into sixteen coordinate sections as shown on the activity sheet. Use a marker and a meter stick to draw the grid on the want ad sheets.
2. Have the students sit so that they are at least two or three meters from the moth environment.
3. Pass out the activity sheets and discuss. Students are to decide on a key for describing the moths, i.e. Brown = B, Want Ad = W, etc. Note: Five lines are given so that you can increase the number of kinds of moths.
4. Using their key students will map the locations of the moths in the moth environment on the activity sheet grid. Do not allow the students to go near the sheet for a closer look. Tell them to mark all of the moths they see on the grid.
5. Students will complete the "My Record" section by labeling the columns with their codes and recording the coordinates (letter, number) of each moth that was found. Each type of moth has its own column.
6. Ask the students to add the columns and record the total number of each moth that they found. Point out all of the moths to the class and have them record the actual number of each kind.
7. Complete the table and graph on page two with the data from page one and write a conclusion about the effectiveness of camouflage.
8. Discuss these conclusions.

IX. Discussion Questions
1. How did the moth's color affect its ability to be found?
2. Which color was the easiest to locate?
3. Which color was the most difficult to locate?
4. Were there factors other than camouflage that affected your ability to locate each moth?

X. Extended Activities
1. Use different color moths.
2. Make moths from felt instead of paper.
3. Do this activity on the grass in a marked off area using various shades of green moths.

XI. Curriculum Coordinates

Math:
Make a coordinate map of your classroom showing where each desk is located.

Computer:
Move the turtle in LOGO by giving it coordinates and using the set position commands.

Social Studies:
Use a United States map and identify the coordinates of each state capital.

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Moth Maps

Key: Description of moth

Code

Moth Map

	A	B	C	D	
4					4
3					3
2					2
1					1
	A	B	C	D	

Name _____

My Record

Code					
MAP LOCATION					
Total Found					
Actual Total					

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Name _____

MOTH MAPS

Using the information from the "My Record" section of page one, complete the table and graph.

Moth Type	Total Found	Actual Total	Found / Total	Decimal Equivalent	Percent Found

Graph the percent of each type that were found.

Type	0	10	20	30	40	50	60	70	80	90	100

What can you conclude about the effectiveness of camouflage?

_____

_____

_____

_____

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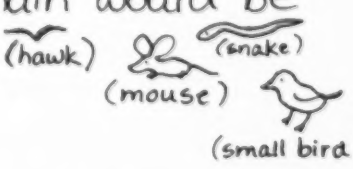
Food Chains

Living things need food to give them energy. A food chain is the path by which energy passes from one living thing to another. Green plants use energy from the sun to make food. Green plants are called producers because they are responsible for making the food that the higher level animals (consumers) eat.

Consumers that only eat plants are called herbivores.

Those that eat only meat are called carnivores,

and those that eat plants or meat are called omnivores.

A food chain is a simplified way to look at the energy that passes from producers to consumers. A food web is a more realistic way of looking at the relationships of plants and animals in an environment. A food web is created when several food chains are linked together. Predators eat a variety of prey. It is likely that a predator from one food chain would be linked to the prey of a different chain. 

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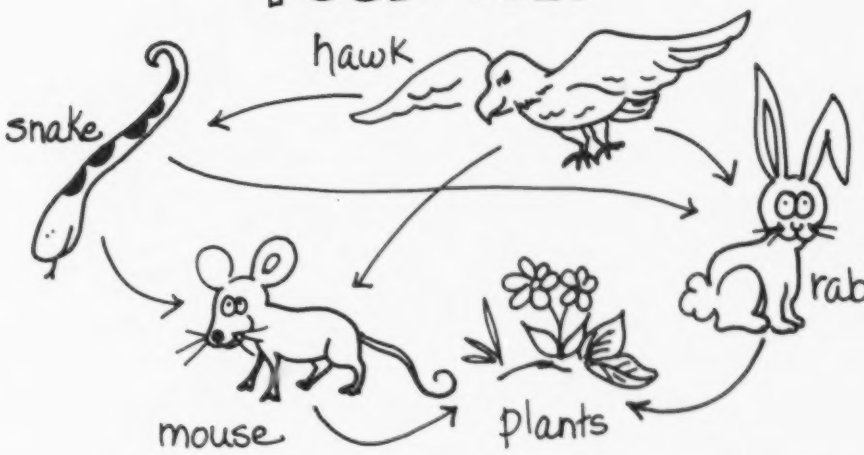
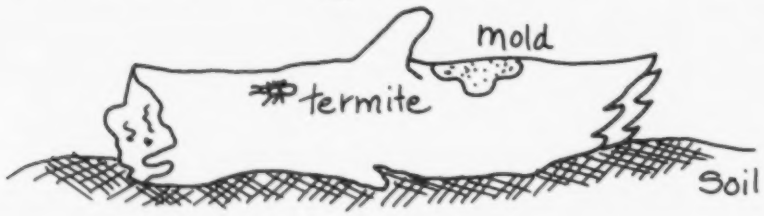
FOOD WEB



How many food chains can you make from this food web?

Decomposers are an important link in a food chain or web. They are microorganisms that are able to break down large molecules into smaller parts.



Decomposers can be found at any link of a food chain. They return the nutrients that are in a living thing to the soil. Without decomposers, future generations of plants would not have the nutrients they need to grow.

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CATCH ME IF YOU CAN

I. Topic Area

Food chains and predator/prey relationships

II. Introductory Statement

Students will play a tag game to experience the relationships between predators and their prey in a food chain.

III. Math Skills

a. Computation
b. Area
c. Comparing

Science Processes

a. Observing
b. Gathering data
c. Generalizing
d. Applying

IV. Materials

brown, red and yellow yarn cut into pieces about 40 cm long as follows:
brown, enough for half the class; red, enough for ⅓ of the class; yellow, ⅓ of the class also
large bag of popped popcorn
sandwich size baggies, 1 per student
Optional — 1 small bag of cheese popcorn for extension activity

V. Key Question

How is energy passed along a food chain from link to link?

VI. Background Information

All foods contain chemical energy. A food chain shows the transfer of energy through the chain. Energy is released from the sun and converted by green plants (producers in the food chain) that use light to make food through photosynthesis. Primary consumers are dependent on green plants, and thus the sun, for food energy. Higher level consumers are dependent on the animals that eat plants or other animals, thus the energy is passed from link to link in the food chain. All links are ultimately dependent on the sun for their food energy. Some energy is lost between each link in a food chain. Because of the energy loss, each higher level has fewer living things than the level below it, thus food chains rarely exceed four links. A pyramid of energy illustrates the energy transfer between predators and prey. Animals at the top of the pyramid are fewer in number and need to eat many smaller animals to get enough energy to survive. The primary consumers that feed on green plants are much more numerous. In a well balanced ecosystem, the producers and consumers at each level have numbers that are large enough to insure their survival without depleting their food supply, thus the pyramid effect with many producers and primary consumers and few of the highest level consumers.

VII. Management Suggestions

1. Find an area with well defined boundaries for this outdoor activity.
2. Stress safety and demonstrate the proper way to tag. Make sure students understand the rules before going outside.
3. Use the activity sheet after the final round of play.

VIII. Procedures

1. Discuss food chains and food webs. Refer to science texts or study prints to illustrate this idea. Discuss predator/prey relationships.
2. Tell the students they are going to play a tag game that will simulate a natural food chain and illustrate a biomass pyramid.
3. Divide the class into 3 even groups. Each group will be assigned a different color of yarn. Pass out the yarn and have each student tie the yarn around his or her wrist in a bow, so that they are easy to remove at the end of the game.
4. The animals the students simulate are represented by the colors of yarn.
   Brown = grasshoppers Yellow = lizards
   Red = hawks
5. Explain the predator/prey relationships in this chain.
   Hawks hunt only lizards.
   Lizards hunt only grasshoppers
   Grasshoppers eat only grass (which is represented by the popcorn).
6. Pass out a baggie to each student which will be used as a stomach. The students playing grasshoppers will put popcorn gathered from the ground into their baggies. The students playing lizards will try to tag the grasshoppers. If they are successful the grasshopper is "dead" and the contents of its baggie are emptied into the lizards bag (the empty baggie stays with the grasshopper to be used again in the next round). Lizards and hawks may not pick up popcorn from the ground. Hawks may only tag lizards and if successful, get the contents of the lizards' baggies.
7. For the animals to survive, they must not be tagged during the game and their stomachs (baggies) must be filled as follows by the game's end.
   grasshoppers — ⅓ full
   lizards — ⅔ full
   hawks — full
8. Go outdoors and select an area to be the ecosystem. For the first round, the area should be small, so that the students can experience the effects of crowding on animal populations. Students may not leave the area during the game.

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9. Set up two or three safe zones within the area. Animals may not prey on each other in these zones. Select an area for the "dead" animals (those that are tagged) to wait for the next rounds.
10. Spread out a large bag of popped popcorn over the ecosystem.
11. Signal the primary consumers, the grasshoppers, to begin eating grass (gathering popcorn). After 30 seconds allow the lizards to enter the area. After 30 more seconds allow the hawks to enter the ecosystem. Allow the students to play for several minutes or until there are no more prey. At the end of play all remaining animals must have the right amount of food in their baggies, or they too are dead. Note the length of time the game lasted.
12. After round one, ask why the game only lasted a few minutes. Discuss crowding and the number of predators vs. number of prey. Write down the number and kinds of animals that are still alive.
13. The second round can be played in the same area as round one, with the following changes, half the students will play grasshoppers (brown), the other half should be divided so that two-thirds of them are lizards and one-third are hawks. Play the game again. Discuss the effects changing the population numbers had on the time the game lasted.
14. For the third round leave the animal poplations as they were in round two but greatly enlarge the area in which the game is played. Discuss the effects of the larger area on the time the game lasted.
15. Return to the classroom. Use the activity sheet to illustrate the numbers of predators and prey in an ecosystem and to make a biomass mobile. Discuss the energy flow from the producers to the higher level consumers. Emphasize that the energy in a food chain originates from the sun. A biomass pyramid could also be made by centering and gluing the pieces, one on top of another.

IX. Discussion Questions

1. Why did the games end? How long should they last?
2. What numbers of predators and prey worked the best?
3. How does area affect predator/prey relationships?
4. How is this game related to a real ecosystem?
5. Create a food chain and discuss.
6. Where does grass get energy?
7. How is the biomass mobile related to the predator/prey game? Why are green plants so important in a food chain?

X. Extended Activities

1. Mix some cheese popcorn with the large bag. Have it represent a pesticide. Do not point this out to students until the end of the game. An animal with three or more cheese corn kernels in their stomach would have died to toxic poisoning.
2. Create a variety of food chains using other animals.
3. Play the game introducing predator/prey behaviors such as camouflage, hunting techniques, decoying, running speed, freezing and playing dead.

XI. Curriculum Coordinates

Geography:

Research various geographical areas and list several food chains.

Art:

Design a poster illustrating food chains and food webs.

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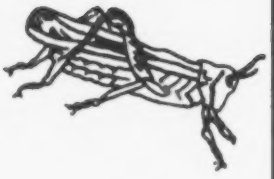
CATCH ME IF YOU CAN...

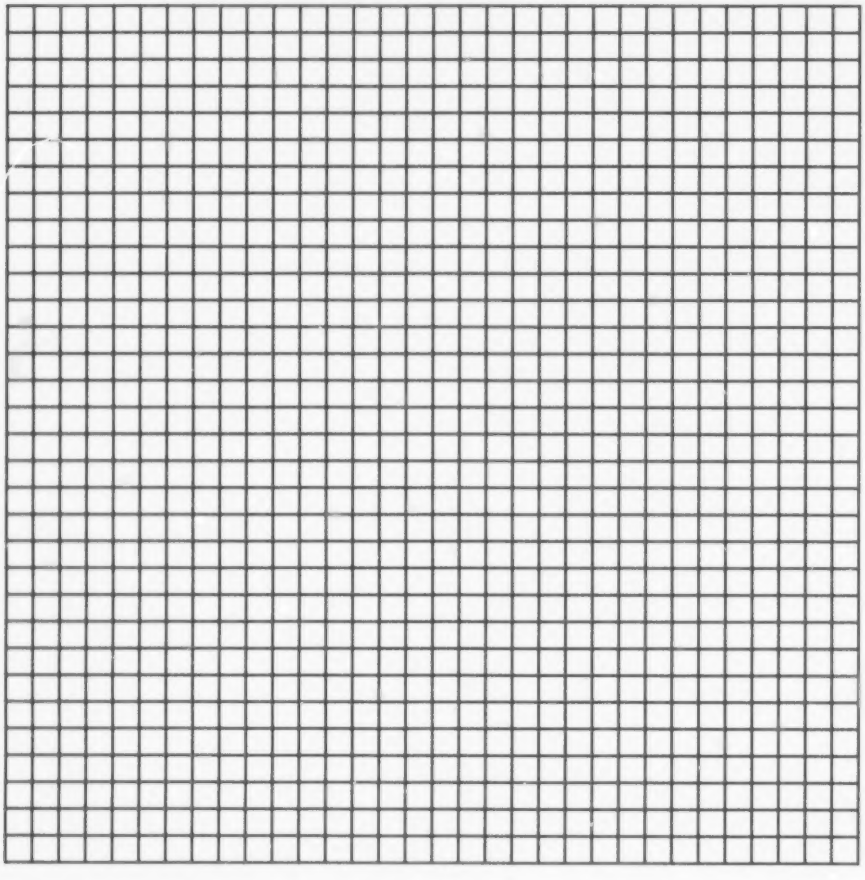


Square	Length	Width	Area
A	x	=	
B	x	=	
C	x	=	
D	x	=	

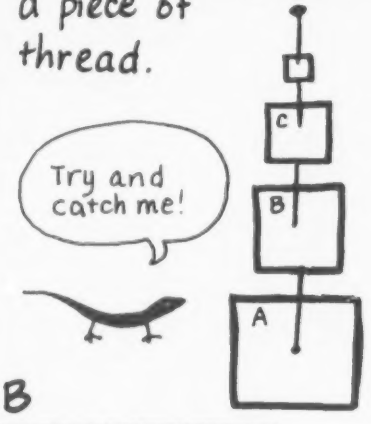
1. Find the area of each square.
2. Imagine that the squares below are part of an ecosystem that includes grass, grasshoppers, lizards and hawks. Think about the numbers of living things in a balanced ecosystem and color the squares according to the key below.

A

grasshoppers = brown lizards = yellow grass = green hawks = red



3. Make a mobile by cutting out the squares and connecting them with a piece of thread.



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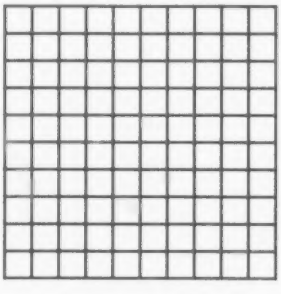

C

D

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CENSUS TAKERS

I. Topic Area
Population sampling

II. Introductory Statement
Students will take samples of a critter population and estimate the total population from the samples.

III. Math Skills
a. Sampling
b. Averaging
c. Graphing

Science Processes
a. Predicting
b. Generalizing

IV. Materials
activity sheets
scissors

V. Key Question
How can you find the population of a large number of animals?

VI. Background Information
Knowing the population of an organism is important in studying it. Many times it is very difficult or impossible to count a large population of organisms. To get a good idea of the total population of an organism scientists determine the area the organism occupies. They then count the number of organisms in random, small sections of the larger area. The numbers of organisms in the samples are then averaged to find the average number of organisms living in a unit area. This unit area varies with the size and range of the organism being studied; for large organisms with a big range the unit might be square kilometers, for smaller organisms, square meters and for even smaller organisms, square centimeters or millimeters. When the average number of organisms per unit area is found, it is used to estimate the total population by multiplying the number of organisms in the unit area by the total area the organism occupies. This gives scientists a fairly accurate population estimate for a given organism.

VII. Management Suggestions
1. Students can work in small groups or individually.
2. Demonstrate how to cut the center square out of the sampling square.
3. Students should only count *whole or nearly whole critters* within the cut out square when they take their samples.
4. Students may count the actual number of critters on the sheet after taking their samples and estimating or be given the correct number (393).

VIII. Procedure
1. Introduce the concept of sampling. This might be done by asking the class how many students are in their school and brainstorming ways that they could find out. Discuss ways to get an answer without counting every student. Students could then do a population study of the school by finding the average number of students per class by counting a few classes and averaging (sampling) and multiplying that number times the number of classes in the school. Compare the results from this method to the actual count from the office.
2. Distribute the activity sheet with the critters drawn on it and have students predict the total number of critters.
3. Pass out the second activity sheet and have each student record their prediction. Have students cut out their sampling square and use it to take five samples of the population. Be sure the samples are randomly taken. Students may drop the cut out square on the critter sheet or close their eyes and place it on the sheet. Students record the number of critters counted in each sample and calculate the average number of critters in a square unit. They multiply the average number of critters for the sample square unit by 63, since the critter population inhabits an area of 63 square units (7x9).
4. Compare the population estimates to the actual count (393 critters) and find the difference.
5. Record each group member's population estimates on the board and make a line graph.
6. Using a different color crayon or pencil, draw a straight line on the graph to represent the actual number of critters. Have the students compare their estimates to the line representing the actual number.
7. Using the group estimates, find the class average of the population estimates and compare it to the actual count.

IX. Discussion Questions
1. Why is it important to select a random sample?
2. How did the population estimates and the actual population differ?
3. Do you think this is an accurate way to determine the population of a large area?
4. Why would this be a particularly good method for finding whale populations?
5. How is a real plot study different from our classroom activity?
6. How does the class average compare to the actual population?

X. Extended Activities
1. Sprinkle sand on a sheet of graph paper and take several samples and find the approximate number of grains on the whole sheet.
2. Have students do a plot study of a local area.

XI. Curriculum Coordinates
Art:
Students can color in the activity sheet attempting to camouflage the critters.
Geography:
Discuss local plants and animals that could be used to do a census.
Science:
Discuss how plot studies may differ at different times of the day and during different seasons.

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CENSUS TAKERS

Name _____

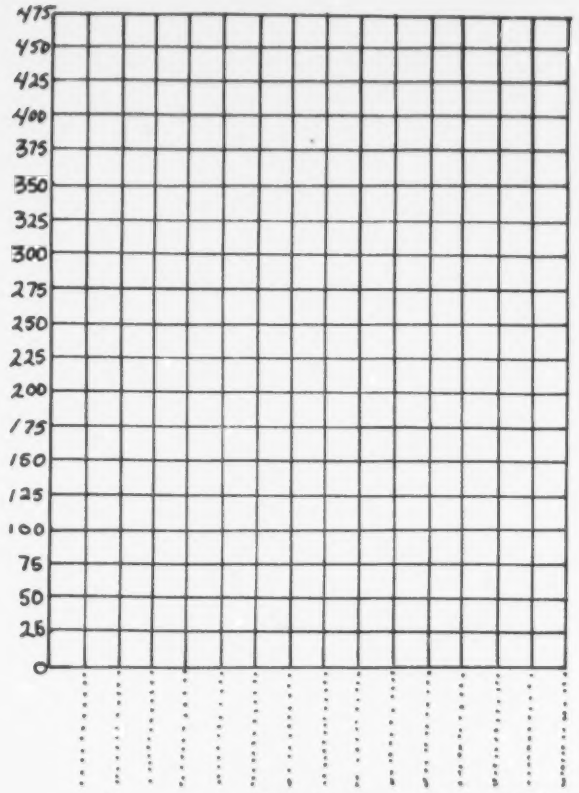
1) Prediction
2) Population Samples

A _____
B _____
C _____
D _____
E _____

3) Sample Total
4) Average (÷ 5)
5) X Number of Square Units
6) Population Estimate
7) Actual Population
8) Difference

POPULATION

Population Estimates

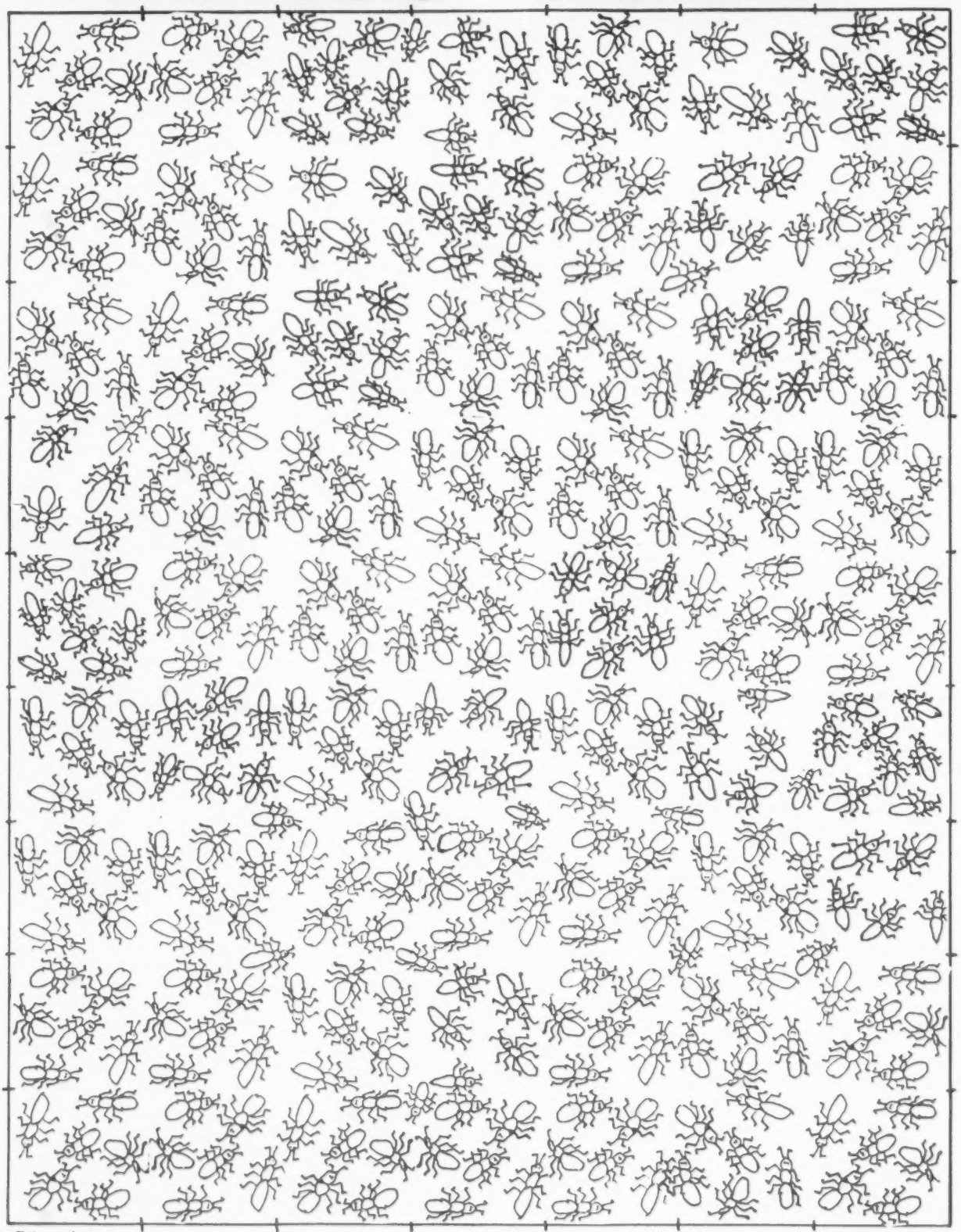


Census Takers

Cut Out

CRITTERS 125 ©1989 AIMS Education Foundation

CENSUS TAKERS



Ellen Small

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WHO'S HOME IN THE BIOME?

I. Topic Area
Biomes

II. Introductory Statement
Students will review which plants and animals are found in each biome by playing a board game.

III. Math Skills **Science Processes**
a. Observing
b. Classifying
c. Collecting
d. Organizing data

IV. Materials
Per group of 4:
4 biome data cards
1 sheet of biome plant/animal record cards
32 blank playing cards
(8 cards per person to draw and label any plants or animals from their biome.)
(3 x 5 cards work well)
pencils
crayons
colored markers

V. Key Question
How are the plants and animals living in a particular biome adapted to the climatic and geographical features of that biome?

VI. Background Information
A biome is an area that is comprised of similar geographical and climatic features, with rainfall and temperature being particularly important. It is also characterized by the distinctive life forms of plants and animals that inhabit it. The location of biomes on a world map will show a latitudinal and altitudinal succession. Because of the impact of climate, certain types of producers will flourish, as will the consumers in their food chain. Thus, biomes are often identified by the plants and animals that inhabit them. This lesson will focus on six land biomes and two water biomes. Some sources break down the biomes further, listing more land and marine biomes. The eight biomes covered in this activity are detailed on the biome data cards.

VII. Management Suggestions
1. This game is most useful as a follow-up or reinforcement activity for a Biome unit. It can be played over and over again. Playing cards can be saved in baggies and reused.
2. Cut out the biome plant and animal record cards before starting the game.
3. If students have a hard time drawing the plants and animals on the blank playing cards, they can paste pictures of plants and animals cut from old magazines on the blank cards instead. The playing cards should be labeled with the name of the plant or animal.
4. You may want to study and discuss the world biome map before playing the game.

VIII. Procedure
1. Place students in groups of four.
2. Each student selects or is assigned one of the eight biomes.
3. Students read their biome data card and choose eight plants and/or animals that live in that biome.
4. Students record these eight choices on their biome record card and draw pictures of plants and animals chosen on the blank playing cards. They will label these pictures. Students can also use cutout pictures of plants and animals.
5. Explain the rules and begin play.

Rules:
1. Shuffle all the group's plant and animal playing cards together.
2. Deal three playing cards to each player and place the rest in a pile in the center of the group, face down.
3. First player asks any other player for a plant or animal from his biome record card. If the player asked has it, he must give it to that player. First player can then go again. If the player asked does not have the card, player says "go search." First player then draws one card from the pile and the next player takes a turn.
4. Play continues until someone collects five cards listed on their biome record card and calls out "Biome".

IX. Discussion Questions
1. Did anyone have the same plant or animal as another player?
2. How is it possible for a plant or animal to live in more than one biome?
3. What plants and animals are restricted to a single biome?
4. Which biomes have the most limited selection of plants and animals? Why?

X. Extended Activities
1. Have students find out what biome they live in and find additional native plants and animals that live there.
2. Study the world biome map. Use a blank map to draw in one of the eight biomes studied.

XI. Curriculum Coordinates
Drama:
Do a puppet show that teaches about a biome.
Language Arts:
Interview your favorite animal and find out all about its biome.
Art:
Make a three dimensional model or diorama of a biome.
Geography:
Research what biomes you would travel through if you traveled from the North Pole to the South Pole. Is there a pattern?

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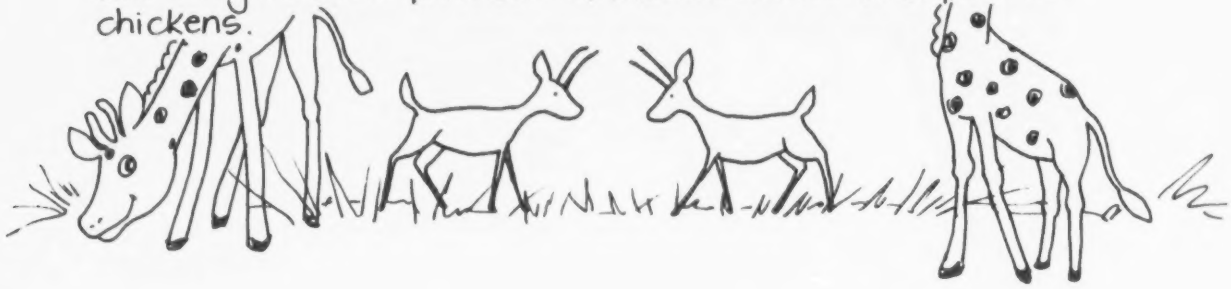
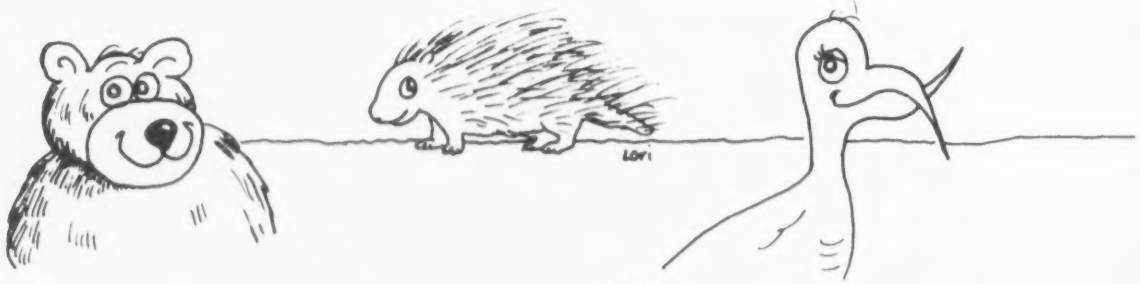
Name _____

Grasslands : The grasslands are often known by other names such as steppes, plains, pampas, savannahs and veldts depending upon where they are located. Grasslands can be found in Africa, Australia, North America, South America and Asia. These areas get between 25-75 cm of rain per year and produce all kinds of grasses, wheat and corn. The animals that live there are mostly plant eaters like gophers, rabbits, giraffes, gazelles, buffalo and antelope. In North America bison used to be found on the grasslands. A variety of birds live on the grasslands. Some of them are ring necked pheasants, meadowlarks and prairie chickens.



Taiga : The taiga or coniferous forest is probably the world's largest land biome. It is located south of the tundra and stretches across portions of North America, Europe and Asia. During the summers, the soil remains very wet and is suitable for lichens and mosses. Fir and spruce trees grow well in this environment. The trees provide homes for many birds including the crossbill, which is capable of cracking cones to eat the seeds. A variety of animals are found in the taiga. They include moose, weasels, wolves, deer, lynx, caribou, porcupines, beaver, mink and bears.



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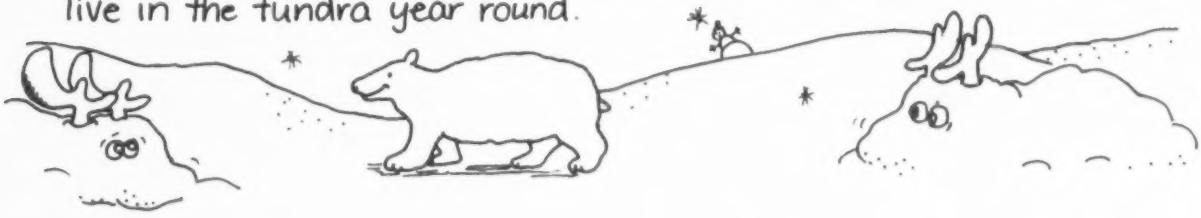
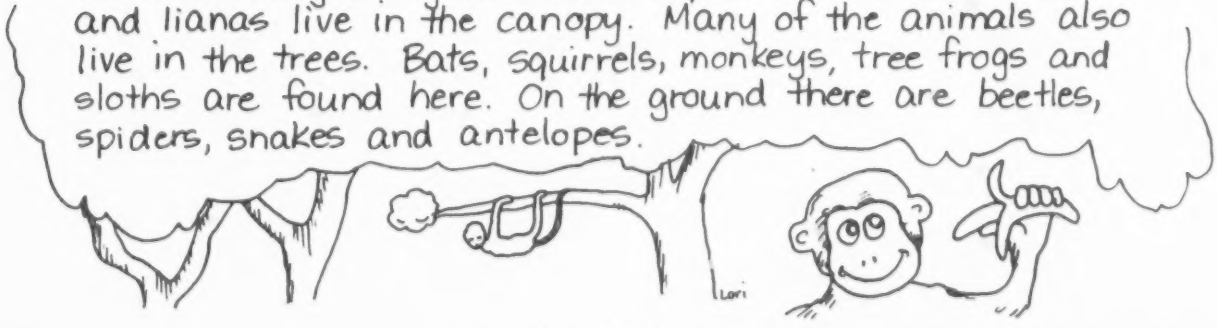
Tundra : The tundra is the coldest biome. It is found around the Arctic Circle and portions of Antarctica. The tundra gets very little precipitation and most of its water comes from snow. Although there is some thawing, a layer called permafrost, remains permanently frozen year round. Because of the severe weather conditions there are limited producers. These include lichens, reindeer moss, true mosses, and some low shrubs and sedges. Trees cannot establish root systems through the permafrost. Although there is a variety of animal life, many animals live in the tundra only during the summer. Caribou, polar bears, foxes, snowshoe hares, mice, and moles can be found there. Flies and mosquitoes have adapted their life cycles to the extremes of the tundra weather and live in the tundra year round.



Tropical Rain Forest : The tropical rain forest is found around the equator where temperatures are about 25°C all year, and there is an average rainfall of 200 cm. Portions of South America, Central America, Central Asia, Australia and Africa are included in the biome. Because of the humid conditions, this biome has the greatest amount of plant growth. Large trees, such as banyans, wild figs and mahogany form a canopy that prevents much light from reaching the ground. Other plants like bromeliads and lianas live in the canopy. Many of the animals also live in the trees. Bats, squirrels, monkeys, tree frogs and sloths are found here. On the ground there are beetles, spiders, snakes and antelopes.



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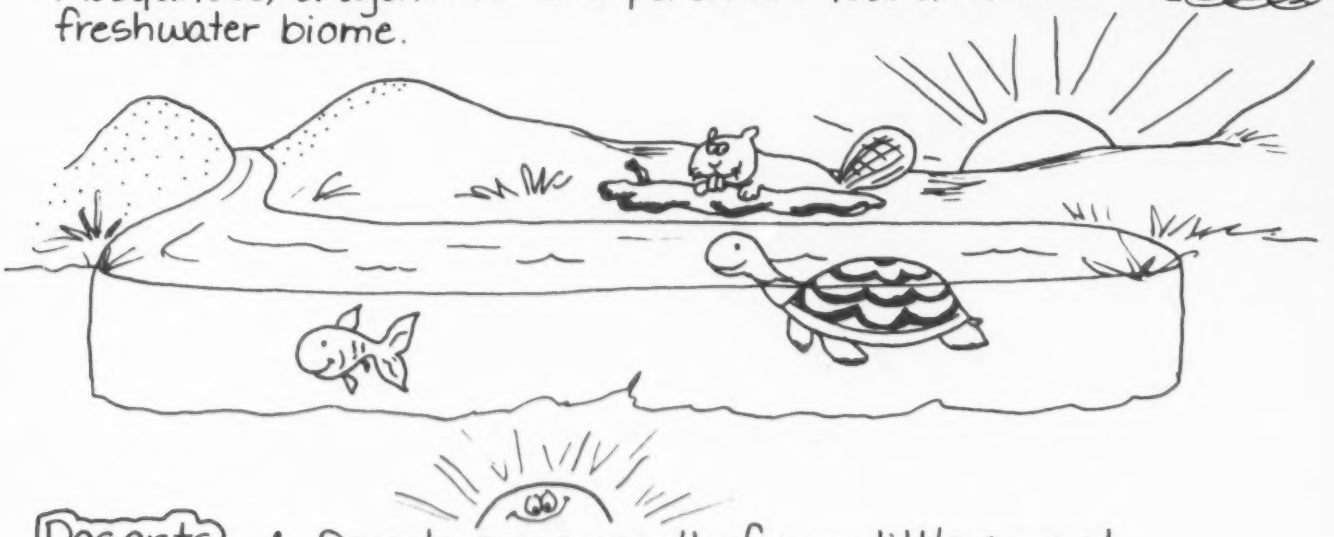
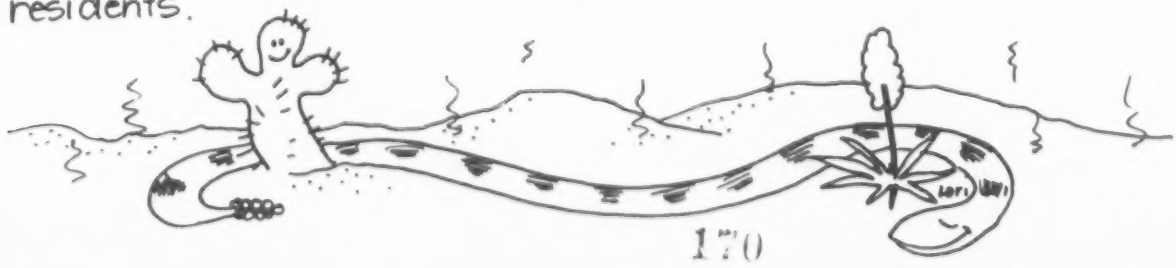
Freshwater Biome : Fresh water all over the world makes up this biome. It includes rivers, lakes, streams and ponds. Algae is a plant common to all these bodies of water. Elodea, duckweed and water lilies are other freshwater plants. Many animals live in the water as well as the shoreline. Beaver, trout, frogs, turtles, crayfish, snails, salamanders, mosquitoes, dragonflies and perch are found in the freshwater biome.



Deserts : Deserts are a result of very little annual rainfall, usually less than 25 cm per year. Not all deserts are hot. Deserts are found in the United States, Africa, Asia, Australia, India and South America. Plants and animals have developed special adaptations for living in this environment. Plants like cacti and yucca trees are spaced far apart and have either little surface area, good water storage or a strong root system. Jack rabbits, kangaroo rats, gila monsters and rattlesnakes have also adapted. Many animals are able to tolerate the heat because they estivate or "sleep" during the heat and move about at night. Owls, hawks and scorpions are other desert residents.



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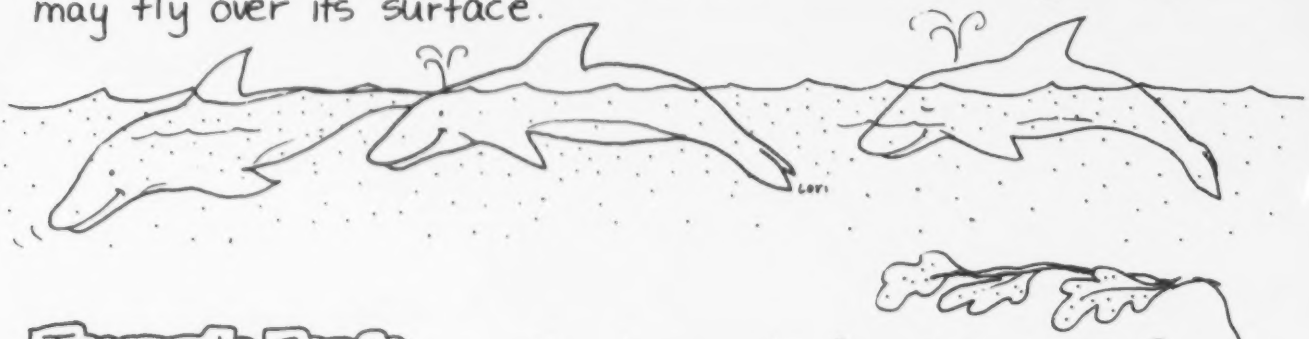
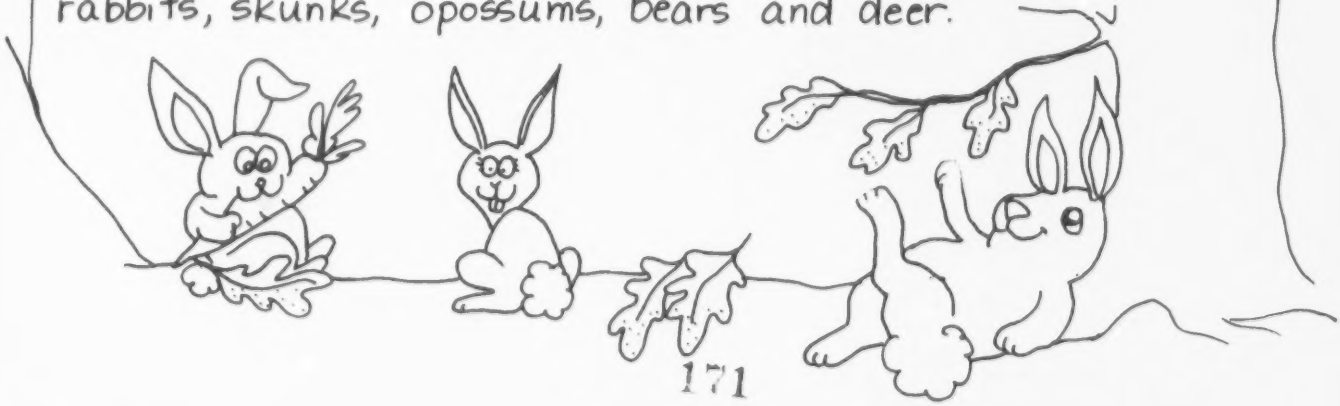
Saltwater Biome: The ocean biome is the largest of all biomes since approximately 7/10ths of the earth is water and most of that is salt water. Any water environment that has at least 3.5% salt is considered salt water. Scientists divide the ocean into smaller biomes by amount of light and temperature. Algae, bacteria and seaweed are found in salt water. The animals found in the ocean are varied depending upon where they live. Clams, crabs, barnacles, flounders, mussels, oysters, sea cucumbers and stingrays live close to shore. In the ocean there are whales, sharks, swordfish, octopi, sea lions, dolphins and tuna. The ocean is the only biome that insects do not live in, although they may fly over its surface.



Temperate Forests: The temperate forest consists of areas that have an annual rainfall of 100 cm per year. These areas are found in North America, South America, Asia and Europe. This biome has four distinct seasons but rarely has a snowcover all winter. Many trees, including beeches, maples, oaks and hickories grow in the temperate forest. All of these trees lose their leaves during the fall. Visitors will find worms, insects, salamanders and snakes on the ground. Mammals include squirrels, raccoons, rabbits, skunks, opossums, bears and deer.



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Ecologist:

Biome:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Ecologist:

Biome:

1. _____
2. _____
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Ecologist:

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Ecologist:

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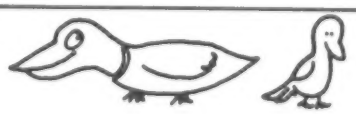

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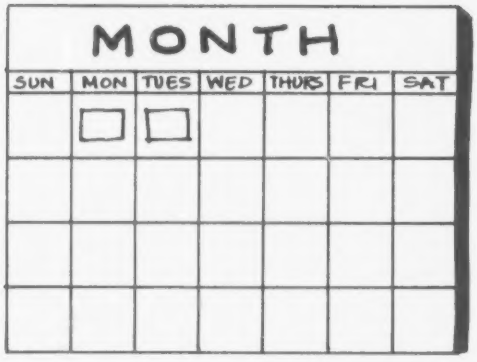
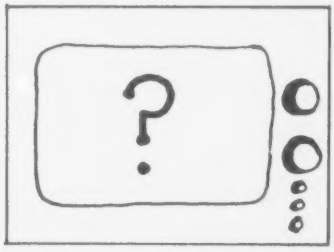
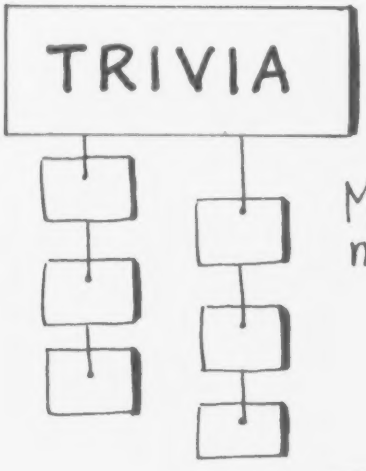
Critter Trivia Ideas



Read one trivia card each day and place it on the calendar.

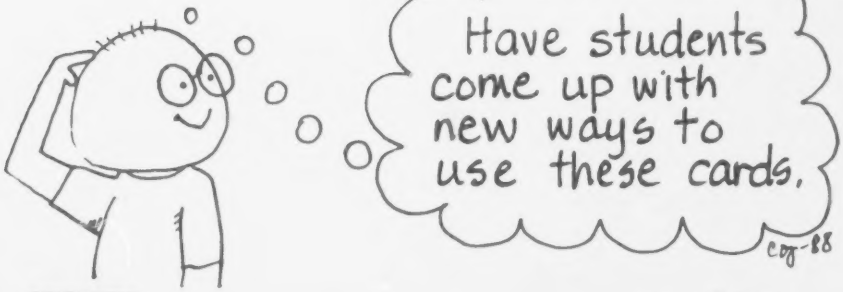


Make up questions using trivia cards- ask them in a "game show" format.



Make a mobile

Trivia Charades



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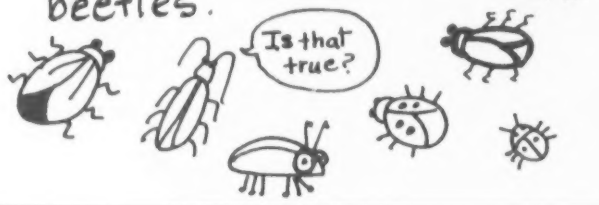
Critter Trivia

There are more than 250,000 kinds of beetles.



Earthworms have no eyes.

People used to think pillbugs were "good medicine" and swallowed them like pills.

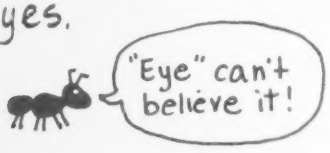
40,000 silkworm eggs weigh approximately one ounce.

The giant African snail grows to about 6".

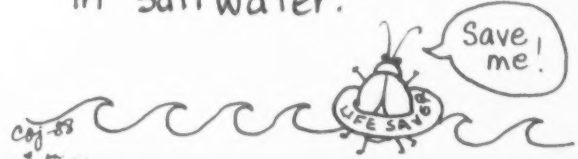
Fairyflies are so tiny that 2 of them can fit on a period.

Insects never close their eyes because they have no eyelids.

An ant's compound eye is made of 50 small eyes.



Insects do not live in saltwater.



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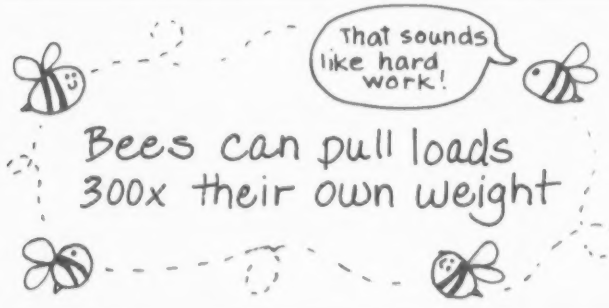
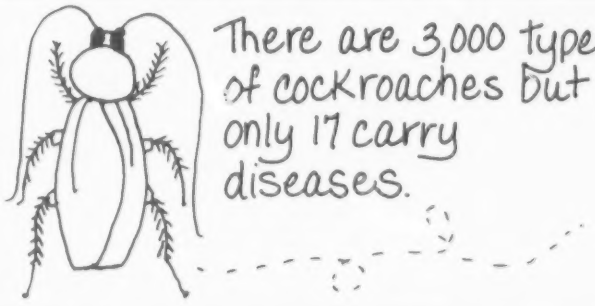
A mother turbot fish can lay 9,000,000 eggs.

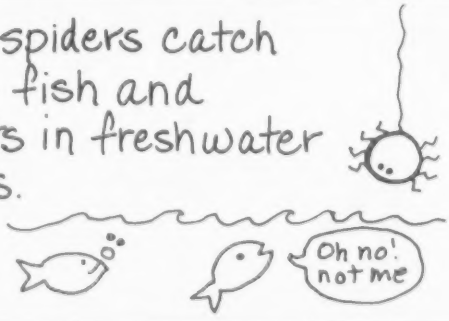




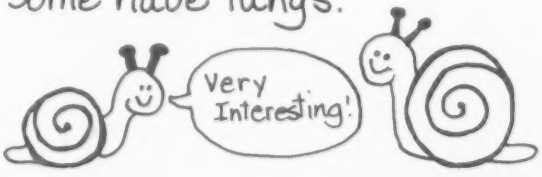
The Chinese were the first to discover silk.

A Mudskipper fish has the head of a frog.

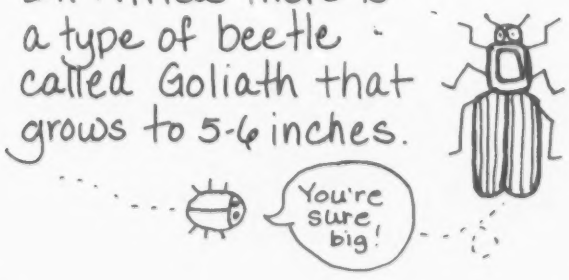
Some spiders catch small fish and insects in freshwater ponds.



Some freshwater snails have gills and some have lungs.



In Africa there is a type of beetle called Goliath that grows to 5-6 inches.



Prawns, sole and chameleons can all change their color for camouflage.

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